CITY OF SHASTA LAKE/SHASTA LAKE FIRE PROTECTION DISTRICT

LOCAL HAZARD MITIGATION PLAN

Prepared for:

City of Shasta Lake
1650 Stanton Drive
Shasta Lake, CA 96019

Shasta Lake Fire Protection District
4126 Ashby Court
Shasta Lake, CA 96019

Prepared by:

Wood Rodgers, Inc.
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June 2005

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Acronyms

BFE	Base Flood Elevation
CDF	California Department of Forestry and Fire Protection
CMP	Corrugated Metal Pipe
CRS	Community Rating System
DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000
DWR	California Department of Water Resources
FEMA	Federal Emergency Mitigation Assistance
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRAP	Fire Resource and Assessment Program
GIS	Geographic Information System
HEC-2	Hydrologic Engineering Centers Model 2
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HMGP	Hazard Mitigation Grant Program
IMEUC	Implementation, Monitoring, Evaluation, and Update Committee
LHMP	Local Hazard Mitigation Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OES	California Governor's Office of Emergency Services
PDM	Pre-Disaster Mitigation Program
PA	Public Assistance Program
PGA	Percent Gravity Acceleration
RAMS	Risk Assessment and Mitigation Strategies
RCP	Reinforced Concrete Pipe
SFHA	Special Flood Hazard Area
USDOT	U.S. Department of Transportation
USACOE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WNV	West Nile Virus

Acknowledgments

Wood Rodgers, Inc. prepared the Local Hazard Mitigation Plan under the planning and participation of the project Steering Committee and staff from the City of Shasta Lake, the Shasta Lake Fire Protection District, Shasta County, and members of the public.

Project Steering Committee Members:

Adrian Rogers	Shasta Lake Fire Protection District
Carla Thompson	City of Shasta Lake, Development Services
Dennis Daily	City of Shasta Lake, Public Works
Fred Wyckoff	Shasta Lake Fire Protection District
Gerry Cupp	City of Shasta Lake, City Manager
John Jones	City of Shasta Lake, Management Analyst
Lt. Denis Carroll	Shasta County Sheriff's Office

Multi-Jurisdictional Plan Adoption

The Local Hazard Mitigation Plan is a joint effort funded by the City of Shasta Lake and the Shasta Lake Fire Protection District. Both participating jurisdictions' governing bodies have signed a plan adoption resolution, following this page, to be eligible for approval by the Federal Emergency Management Agency (FEMA).

RESOLUTION CC05-48

A SHASTA LAKE CITY COUNCIL RESOLUTION AUTHORIZING THE ADOPTION OF A LOCAL HAZARD MITIGATION PLAN AS REQUIRED BY SECTION 322 OF THE DISASTER MITIGATION ACT OF 2000.

WHEREAS, the jurisdictions of the City of Shasta Lake and the Shasta Lake Fire Protection District, California, has experienced disasters that have damaged commercial, residential, and public properties, displaced citizens and businesses, closed streets and bridges, and presented general public heath and safety concerns; and

WHEREAS, the City of Shasta Lake and the Shasta Lake Fire Protection District, California, has prepared a Local Hazard Mitigation Plan that outlines the City of Shasta Lake 's option to reduce overall damage and impact from natural hazards; and

WHEREAS, the Local Hazard Mitigation Plan has been reviewed by the City of Shasta Lake and the Shasta Lake Fire Protection District, local citizens, and federal, state, and local agencies and has been revised to reflect their comments.

NOW, THEREFORE BE IT RESOLVED,

1. That the City of Shasta Lake and the Shasta Lake Fire Protection District Local Hazard Mitigation Plan is hereby adopted as an official plan of the city of Shasta Lake and the Shasta lake Fire Protection District, California.
2. A Plan Implementation, Monitoring, Evaluation, and Update Committee will be established as designated in the Local Hazard Mitigation Plan.
3. The Plan Implementation, Monitoring, Evaluation, and Update Committee shall convene at least once per year and shall monitor implementation of the plan and shall submit a written progress report to the City of Shasta Lake City Council and the Shasta Lake Fire Protection District Board of Directors in accordance with the following format:
   a. An evaluation of the original plan.
   b. An evaluation of any disasters or emergencies that occurred during the previous year.
   c. An evaluation of the actions taken and what was accomplished during the previous year.
   d. A discussion of any mitigation implementation or funding issues.
   e. Recommendations for new projects or revised action items. Such recommendations will be subject to the approval by the City of Shasta Lake City Council and the Shasta Lake Fire Protection District Board of Directors.
4. The City of Shasta Lake and the Shasta Lake Fire Protection District shall submit an updated Local Hazard Mitigation Plan every 5 years to the Federal Emergency Management Agency.

PASSED, APPROVED, AND ADOPTED

AYES: **FARR, HURLHEY, SINER, GOEKLER**
NOES: **NONE**
ABSENT: **DURYEE**

DEAN GOEKLER, Mayor

ATTEST:

RAE MORROW, City Clerk

City of Shasta Lake Council/Shasta Lake Fire Protection District

ADOPTION RESOLUTION
05-04

WHEREAS, the jurisdiction of the City of Shasta Lake and the Shasta Lake Fire Protection District, California has experienced disasters that have damaged commercial, residential and public properties, displaced citizens and businesses, closed streets and bridges and presented general public health and safety concerns; and

WHEREAS, the City of Shasta Lake and the Shasta Lake Fire Protection District, has prepared a Local Hazard Mitigation Plan that outlines the City of Shasta Lake and the Shasta Lake Fire Protection Districts options to reduce overall damage and impact from natural hazards; and

WHEREAS, the Local Hazard Mitigation Plan has been reviewed by the City of Shasta Lake and the Shasta Lake Fire Protection District, local citizens, and federal, state and local agencies, and it has been revised to reflect their comments.

NOW, THEREFORE, BE IT RESOLVED THAT;

1. The City of Shasta Lake and the Shasta Lake Fire Protection District Local Hazard Mitigation Plan is hereby adopted as an official plan of the City of Shasta Lake and the Shasta Lake Fire Protection District.
2. A Plan Implementation, Evaluation, and Update Committee will be established as designated in the Local Hazard Mitigation Plan.
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   a. An evaluation of the original plan.
   b. An evaluation of any disasters or emergencies that occurred during the previous calendar year.
   c. An evaluation of the actions taken, including what was accomplished during the previous year.
   d. A discussion of any implementation problems.
   e. Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by the City of Shasta Lake Council and the Shasta Lake Fire Protection District Board of Directors.
4. The City of Shasta Lake and the Shasta Lake Fire Protection District shall submit an updated LHMP every five years to FEMA.

Passed this 13th day of June, 2005.

Signed by;

Shasta Lake Fire Protection District

6-13-05
Jack Ferguson, Chairperson

06-13-05
Gary Nicholls, Vice Chairperson

6/13/05
Oly Olsen

6-13-05
Ted Chase

Tim Hopkins

Executive Summary

This Local Hazard Mitigation Plan (LHMP) addresses the major natural hazards within the boundaries of the City of Shasta Lake (City) and the Shasta Lake Fire Protection District (Fire District). The LHMP provides:

- A risk assessment component that profiles the natural hazards within the City and Fire District boundaries and identifies fire and flooding as the major hazards in the area.

- A vulnerability assessment and potential monetary loss estimate due to fire and flooding; which are the two major natural hazards identified by the City and Fire District to pose the greatest immediate threat to life and property.

- Fire and flooding mitigation goals and actions that identify a lead agency or individual, potential funding resources, and designates a short-term or long-term schedule.

- Actions to implement to achieve the mitigation goals through existing programs.

- A commitment and strategy to continue public involvement in the implementing, monitoring, evaluating, and updating the LHMP.

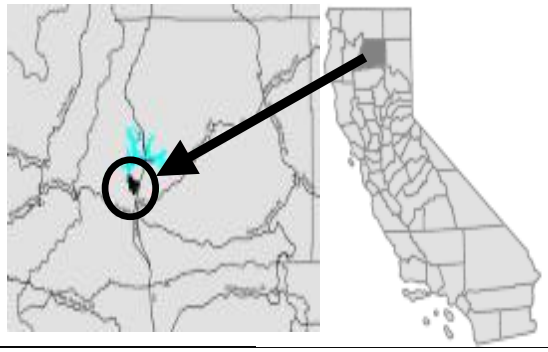
The LHMP was developed with continued involvement from the Steering Committee, which was comprised of City, Fire District, and Shasta County staff to ensure the progress of the planning process, facilitate public involvement, provide data and information, and make the LHMP accessible for public input and review through the City's website and the City office.

SECTION 1.0 INTRODUCTION

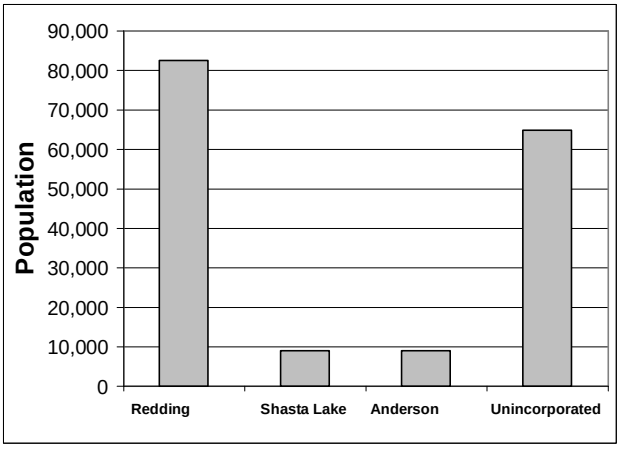
Community Profile

The City of Shasta Lake (City) and the Shasta Lake Fire Protection District (Fire District) are located in Shasta County, at the northern tip of the Central Valley (area boundaries are presented on Map 1 and Map 2, Appendix A). The Fire District boundary is the same as the City boundary except for a small section on the east side of the City where the Fire District boundary extends eastward for approximately one mile.

City of Shasta Lake/Shasta Lake Fire Protection District



Thousands of job seekers traveled to Shasta County in 1937 after the U.S. Bureau of Reclamation (USBR) announced the construction of Shasta Dam. As a result, three distinct cores of residential and commercial developments grew by the summer of 1938: Summit City, Project City, and Central Valley. By 1980, population figures stood at 1,139 for Summit City, 1,659 for Project City, and 3,424 for Central Valley (Rocca, 2004). When the three cities were incorporated as the City of Shasta Lake in July 3, 1993, the area's total population stood at 9,800. The Fire District boundary, established previously in the 1940s, adds approximately 200 more people to the total population within the City and Fire District boundaries.



There are three incorporated cities in Shasta County: Redding, Anderson, and the City of Shasta Lake. Shasta Dam, Lassen Volcanic National Park, Shasta Lake (the largest man-made lake in California), Mt. Shasta, Whiskeytown Lake, and the Trinity Alps attract visitors to Shasta County each year. Shasta County experiences predominately warm, dry summers and mild winters with the majority of precipitation as rainfall experienced during winter months. According to the 1999 California Department of Finance census data, the primary industries in Shasta County are retail trade and services (Table 1-1a).

Table 1-1
Shasta County Number of Establishments by Industry and Employment Size, 1999

Industries	Establishments
Mining/Utilities Construction	591
Manufacturing	178
Trade **	899
Transportation & Information	200
FIRE ***	405
Services	1,939
Forestry, Fishing, etc	76
Auxiliary	6
Unclassified	86
All industries	4,380
** *Wholesale and retail.*	
*** *Finance, insurance, real estate, rental, and leasing.*	
Source: California Department of Finance	

Local Hazard Mitigation Plan

In June 2004, the City and Fire District submitted a letter of intent to develop a Local Hazard Mitigation Plan (LHMP) in response to a notice sent by the California Governor's Office of Emergency Services (OES). The notice was sent to all California local governments to ensure they were aware that hazard mitigation project funding is at risk due to the changes in federal pre-disaster mitigation planning requirements in accordance with the Disaster Mitigation Act of 2000 (DMA 2000), which was approved by Congress and signed into law by the President in October of 2000. The purposes of the DMA 2000 are to establish a national program for pre-disaster mitigation and streamline the administration of disaster relief (a copy of the DMA 2000 is provided in Appendix B). Hazard mitigation planning is done on the federal, state, and local level. The federal government has produced the "National Mitigation Strategy" and the state has developed a "Multi-Hazard Mitigation Plan." According to the DMA 2000, a jurisdiction must complete a LHMP by November 1, 2004, to be eligible for certain hazard mitigation

funding from FEMA. FEMA currently has five hazard mitigation funding programs: The Hazards Mitigation Grant Program (HGMP); the Pre-Disaster Mitigation program (PDM); the Flood Mitigation Assistance (FMA) program; Fire Management Assistance; and the Public Assistance (PA) program.

The goal of the City and Fire District LHMP is to assess potential hazards that may affect the community, recommend and facilitate the implementation of hazard mitigation actions, and encourage interagency hazard mitigation coordination to ultimately reduce the loss of life and property caused by natural hazards. The majority of the City's boundaries are within the Fire District boundaries; therefore the LHMP addresses the two jurisdictions as a whole in the risk assessment, vulnerability assessment, and identification and analysis of mitigation goals and actions.

SECTION 2.0 MULTI-JURISDICTIONAL PLANNING PROCESS

The jurisdictions of the City and Fire District participated in the funding and development of the LHMP. A Steering Committee was formed with the responsibility of:

- Ensuring the efficient progress of the planning process.
- Coordinating public involvement and input.
- Providing data and information to develop the LHMP.
- Meeting monthly to review progress and address LHMP development needs.

Steering Committee representatives include:

Adrian Rogers	Shasta Lake Fire Protection District
Carla Thompson	City of Shasta Lake, Development Services
Dennis Daily	City of Shasta Lake, Public Works
Fred Wyckoff	Shasta Lake Fire Protection District
Gerry Cupp	City of Shasta Lake, City Manager
John Jones	City of Shasta Lake, Management Analyst
Lt. Denis Carroll	Shasta County Sheriff's Office

Consultant Team:

Francis Borcalli	Wood Rodgers, Inc., Principal-in-Charge
Muawieh (Mike) Radaideh	Wood Rodgers, Inc., Project Manager
Angela Carmi	Wood Rodgers, Inc., Project Coordinator

To ensure a meaningful public involvement process, the consultants and members of the Steering Committee were responsible for publishing newsletters and scheduling, publicizing, and organizing two public meetings. Copies of Steering Committee and public meeting attendance sheets and meeting agendas are included in Appendix C. Below is a summary of the planning process and public involvement:

- Monthly Steering Committee meetings were conducted to discuss the progress of the LHMP, review technical analyses material, and ensure the public involvement process.

- The LHMP and the public meetings were publicized through different media channels, including a televised interview on Channel 12, an announcement in the Shasta Lake Bulletin, a utility bill insert, a public service announcement, and the public meeting agenda posted on the City Council meeting agenda.

- Two public meetings were organized:

Ø The initial public meeting was conducted on August 3, 2004, 6:30-8:00 p.m., at the John Beaudet Senior Community Center in Shasta Lake, immediately preceding a City Council meeting. Discussion items included the DMA 2000 and funding programs available through the implementation of the LHMP, the process of developing the LHMP, and the hazards to address.

Ø The second public meeting was conducted on October 19, 2004, 6:30-8:00 p.m., at the John Beaudet Senior Community Center in Shasta Lake, immediately preceding a City Council meeting. Discussion items included a brief overview of the DMA 2000, the LHMP elements, and mitigation actions recommended in the LHMP.

Wood Rodgers prepared the LHMP with regular input from the Steering Committee. Comments received from the Steering Committee and the public were documented and used in developing the goals and actions of the LHMP, identifying current hazards in the area, and identifying and prioritizing mitigation actions. Components of the LHMP involved compiling research, reviewing studies and projects conducted in the area, and gathering input from the public. The draft LHMP was shared with the public by posting a draft on the City's website and providing drafts in the City office for public review.

Agency Coordination

The following agencies, programs, and organizations provided information during the development of the LHMP:

American Red Cross
California Department of Forestry and Fire Protection
California Governor's Office of Emergency Services
Center for Disease Control and Prevention
City of Shasta Lake
Federal Emergency Management Agency
National Fire Safe Council
National Oceanic and Atmospheric Administration
Shasta County Sheriff's Office
Shasta Lake Fire Protection District
U.S. Department of Agriculture
U.S. Geological Survey
Western Shasta Resource Conservation District

Local Capability Assessment

Various programs and capabilities in the City and Fire District were assessed for resources necessary for the development, implementation, and maintenance of the LHMP. These resources fall within three primary categories: Technical resources, financial resources, and human resources.

Technical Resources:

- American Red Cross, Shasta Area Chapter – Information about the facilities and staff available for emergency response.
- California Department of Forestry – Geographic Information System (GIS) data, fire management plans, fire threat and analysis, vegetation and fuel hazard data, and fire-fighting and emergency management response plans.

- Shasta County Office of Emergency Services – GIS data, disaster assistance and recovery information, dam failure analyses, and hazard analyses.
- Shasta County Sheriff – Information for emergency response and management, community safety plan, Incident Command System, and the Emergency Response Chart.
- Shasta Lake Department of Development Services – General Plan, FEMA National Flood Insurance Program (NFIP) information, and parcel data.
- Shasta Lake Department of Public Works – Road and infrastructure information, frequently flooded areas information, planning studies, the Storm Water Management Plan, emergency response plans, county municipal codes, and aerial photographs.
- Shasta Lake Department of Wastewater Treatment – Wastewater Risk Management Plan, wastewater treatment plant facilities Storm Water Pollution Prevention Plan and Storm Water Monitoring Program, and hazardous materials site business plans.
- Shasta Lake Department of Water Treatment – Water Treatment Plan, Water Risk Management Plan, water master plans, drinking water program, and hazardous material site business plans.
- Shasta Lake Fire Protection District – Emergency response plans, fire briefings, and land base map.

Financial Resources:

Funding for developing the LHMP was shared between the City and Fire District. Funding mechanisms related to programs through which elements of this LHMP could be implemented include the Pre-Disaster Mitigation (PDM) Program, the Flood Mitigation Assistance (FMA) Program, Fire Management Assistance, the Hazard Mitigation Grant Program (HMGP), and the Public Assistance (PA) Program.

Human Resources:

Human resources available for the LHMP planning process include City staff from the Department of Public Works, Development Services, Finance, Water Treatment, Wastewater Treatment, the Fire District, and the Shasta County Sheriff's Office.

SECTION 3.0 MULTI-JURISDICTIONAL RISK ASSESSMENT

Identifying Hazards

The hazards identified in this section include:

- Urban/Wildland Interface Fires
- Flooding
- High Temperatures
- Droughts
- Dam Inundation
- Earthquakes
- Volcanic Activity
- Hazardous Materials Spills
- Public Health Hazards
- Severe Storms

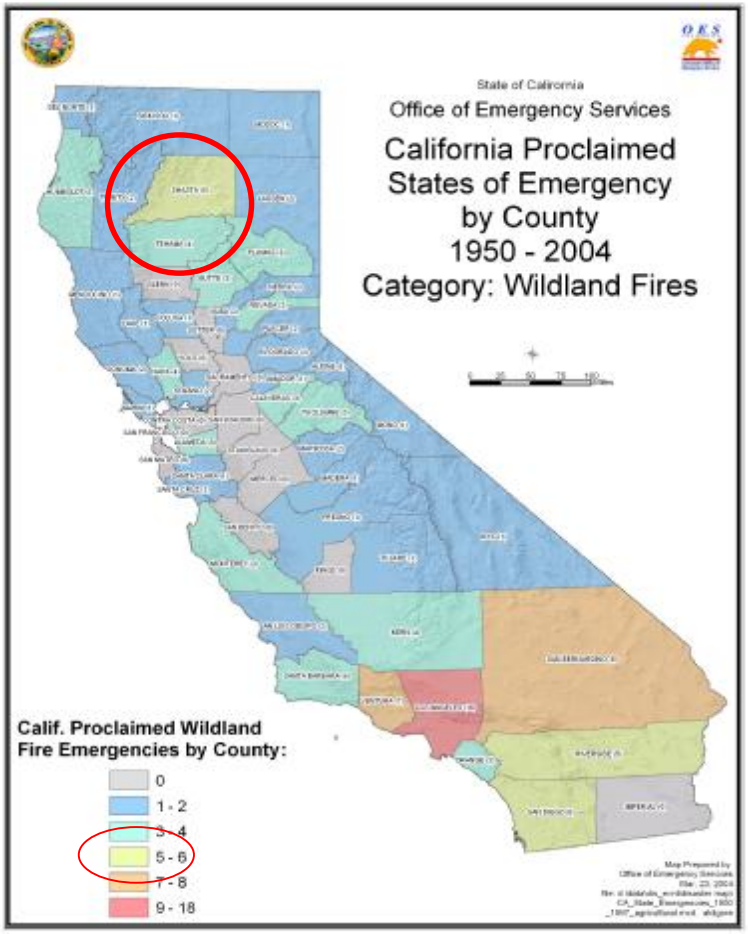
This section provides information to assist in identifying and prioritizing appropriate mitigation actions to reduce losses from major natural hazards in the City and Fire District. The majority of the City boundaries are within the Fire District, with the exclusion of a section of the Fire District on the east side of the City boundary (Map 1, Appendix A). There are no critical facilities in the section of the Fire District that is not contained within the City boundaries and the area contains a low residential density. The LHMP addresses the two jurisdictions as a whole in the risk assessment, which includes detailed descriptions and mapping of the hazards as well as an analysis of the areas vulnerable to those hazards. Specific information about the numbers and types of structures, potential economic losses, and an overall description of land use trends in the region are also included in this analysis.

The Steering Committee identified flooding and wildland/urban interface fires as the two major natural hazards that pose the greatest immediate threat to life and property in the area. Fire and flooding were selected as the major natural hazards within the two jurisdictions based on input received at the initial

public meeting and the results of the hazard profiles, historical data review, and recent events. The focus of the potential loss estimate and the mitigation measures in the LHMP on fire and flooding represents the best use of resources currently available for this process. If additional data and events identify additional or alternative hazards, than the LHMP should be updated accordingly.

Urban/Wildland Interface Fires

Fire-prone conditions develop when hot weather, vegetation accumulation, and low moisture or drought conditions exist. Over the past century, new population growth in the U.S. is encroaching on wildland areas, as cities and suburbia expand into rural areas. Continued encroachment brings people and structures closer to, creating an urban/wildland interface. An urban/wildland interface community "…exists where humans and their development meet or intermix with wildland fuel" (Federal Register, 2001). Placing structures within or adjacent to flammable vegetation renders them extremely vulnerable to wildfire. Should a wildland fire occur in an interface area, homes and other structures could become additional concentrated fuels for the wildfire.



Fuel, topography, and weather can serve as wildfire predictors and determine the nature and duration of a potential wildland fire. Fuel sources include vegetative types and density, tree needles and leaves, branches, twigs, and dead grass, as well as the susceptibility of buildings in a community in terms of their resistance to ignition based upon combustible construction materials. Fire intensity and the rate of fire spread can increase as slope increases. When a fire begins at the bottom of a slope, fuels located uphill are preheated by the rising air, helping them to easily ignite. Weather conditions such as wind, temperature,

relative humidity, and lightening can also affect wildfire potential. Moderate to high winds increase the rate of fire spread and high temperatures that are accompanied by low relative humidity will dry out fuels so that ignition is easier.

Fuel loads on side of Pine Grove Road, Shasta Lake, CA. Photo taken August 3, 2004.

According to the California Department of Forestry (CDF) Shasta-Trinity Unit 2004 Fire Plan, the average leading cause of fires within the area in the last 10 years was due to the use of mechanical equipment, such as lawn mowers on dry grass or faulty equipment. According to the 2004 Fire Plan, most fires begin in the urban/wildland interface on residential property or along roads.

Fuel loads on side of Ashby Road, Shasta Lake, CA. Photo taken August 3, 2004.

According to OES, from 1950-1997, Shasta County has had three State of Emergency proclamations due to wildland fires. CDF determined wildland fire threat as a combination of fire frequency and potential fire behavior. According to CDF, the region within the boundaries of the City and the Fire District is a "Very High Threat" and is very near to areas of "Extreme Threat" which are located directly east (Map 4, Appendix A). According to the CDF Shasta-Trinity Unit 2004 Fire Plan, the City of Shasta Lake has been added as an "At Risk" community, since the initial 2000 Shasta-Trinity Unit assessment.

Fuel load near Cascade Boulevard, Shasta Lake, CA. Photo taken *August 3, 2004.*

Due to the accumulation of fuel in and around the City and Fire District boundaries, the area is considered susceptible to wildland fires. At the end of December 2003, the area within the City and Fire District boundaries experienced an

unusual snowstorm with heavy snow and high winds that resulted in broken tree limbs, fallen telephone lines, and a heavy accumulation of debris. The large amount of downed, suspended, and standing vegetation created a fuel hazard and left the area subject to an extreme fire threat (CDF, 2004). A copy of the Fire Briefing is included in Appendix E. A few months following that event, on August 23, 2004, a proclamation was issued declaring a local state of emergency in Shasta County based upon fire conditions caused by the Bear fire (Jones Valley), French fire, and Lake fire. The French fire caused the evacuation of the entire population of the nearby French Gulch. Meanwhile, the community of Buckeye and the City of Shasta Lake were in danger from the Lake fire and a mandatory evacuation forced approximately 500 people from their homes. Historical fire damage has occurred in the region directly south of the City and Fire District boundaries (Map 3, Appendix A). Although the region within the boundaries of the City and Fire District have been in close proximity to major fire events, the region has not yet sustained any substantial damage attributed to fires for as long as records have been maintained.

Flooding

Although several State of Emergency Proclamations due to flooding have occurred in Shasta County, between 1950-2004 (OES, 2004), the area within the City and Fire District boundaries has not sustained damage attributed to floods. According to the FEMA Flood Insurance Rate Map (FIRM) panels (Map 5, Appendix A), most of the 100-year floodplains are somewhat contained within the channel banks and do not pose a significant or widespread flood threat.

The current City of Shasta Lake Municipal Ordinance, Chapter 15, Articles I-VI, requires permits for developments within the FEMA FIRM SFHA. The ordinance also requires that residential construction and new or substantial improvement in all FEMA flood zones must have the lowest floor elevated one foot above the BFE. The elevation of the lowest floor must be certified by a professional engineer or surveyor and verified by the community building inspector, and the certification must be submitted to the Floodplain Administrator. All encroachments, such as fill, new construction, substantial improvements, and other new developments, are prohibited in the floodway, unless certification by a professional engineer or surveyor can provide evidence that the encroachments would not result in any increase in the BFE during the occurrence of the base flood discharge (Shasta Lake Municipal Ordinance, Chapter 15).

Although riverine flooding does not pose a direct threat, flooding due to local drainage issues during storm events has become an issue for the City and Fire District. The City has identified several culverts or road crossings that are subject to frequent flooding due to localized drainage issues (Map 6, Appendix A). These areas are of concern due to the potential property loss, infrastructure damage, and harm to life:

Culvert at intersection of Mussel Shoals and Front Street, Shasta Lake, CA. Photo taken August 3, 2004.

- 48-inch and 30-inch Corrugated Metal Pipes (CMP) at the intersection of Oak Avenue and Beacon Street;
- Two 36-inch CMPs west of the intersection of La Mesa Avenue and Ashby Road;
- Street flooding along Meade Street between Montana Avenue and Hardenbrook Avenue;
- 24-inch CMP at the intersection of Red Bluff Avenue and Washington Avenue;
- 24-inch CMP on Mussel Shoals Avenue between Red Bluff Avenue and Koch Street; and
- 36-inch CMP at intersection of Parker Street and Grand Coulee Boulevard.

With the exception of the culvert at Parker Street and Grand Coulee Boulevard, none of the culverts identified as being subject to frequent flooding are within the 100-year floodplain. Although the Parker/Grand Coulee crossing is within the 100-year floodplain, it is located in an area designated as shallow (X Zone) flooding that results from out-of-bank spilling from Moody Creek rather than local drainage. Flood incidents at these locations are likely the result of an undersized or unmaintained local drainage system. The local runoff tributary to these culverts as well as the hydraulics of the culverts could not be evaluated without more detailed hydrologic and topographic information.

In the FEMA Flood Insurance Study (FIS) for Shasta County, there are two residential areas that are subject to inundation from split flows during a 100-year storm event. These include:

- The Hilltop Circle crossing on Churn Creek (in the Twin Lakes Mobile Home Park), where shallow flooding occurs during the 100-year storm as a result of an undersized culvert crossing.

- The I-5 crossing on Moody Creek, where the existing pair of 9.5-foot-diameter culverts do not have capacity to convey the 100-year storm. During the 100-year storm, water backs up behind the highway and Shasta Dam Boulevard, eventually overtopping Shasta Dam Boulevard and spilling southward parallel to Shasta Street and Cascade Boulevard.

An initial hydraulic analysis was conducted on the identified flood hazard areas as part of the LHMP and the results are included in the mitigation section (a copy of the hydraulic analysis is provided in Appendix F).

Although properties within Shasta County have sustained FEMA National Flood Insurance Program (NFIP) repetitive losses due to flooding, the region within the City and Fire District boundaries have not.

Drought

Drought is characterized as meteorological, agricultural, hydrological, and socioeconomic. Meteorological drought is due to a period of low or below average water supply. Agricultural droughts occur when there is an inadequate water supply to meet the needs of agricultural operations. A hydrological drought is characterized by low or deficient water and groundwater supply, and a socioeconomic drought results in adverse public health and economic impacts (National Drought

Mitigation Center, 2004). Issues associated with water rights can also compound the water supply and availability issues. Drought is not a distinct event and occurs over an extended time frame. Agriculture, manufacturing, tourism, and commercial and domestic water use all require constant, reliable supplies of water. As the population in the area continues to grow, so will the demand for water. Water supply is affected by decreased storage in reservoirs and dry wells resulting from a declined water table. When reservoirs are low or dry, water users rely on wells to pump groundwater, which lowers the groundwater table.

Shasta County has experienced a state of emergency proclamation for drought, however the City and Fire District have not sustained damages directly or indirectly attributed to drought as far as records have been maintained. According to the National Oceanic and Atmospheric Administration (NOAA), the region within the City and Fire District boundaries are not undergoing drought conditions, as is the region directly east of the City and much of California (Map 7, Appendix A).

High Temperatures

As with drought, the region within the boundaries of the City and Fire District have not sustained damages directly or indirectly attributed to high temperatures as far as records have been maintained. Average temperatures and maximum temperatures for 2003 were above the U.S. average temperatures in the region (Map 8 and Map 9, respectively, Appendix A); however, in a nationwide comparison, the precipitation level was in the moderate to high level in 2003 (Map 10, Appendix A). Accordingly, although the area is prone to high temperatures, precipitation levels counteract the fire threat attributed directly to high temperatures.

Dam Inundation

Based upon information provided by OES, the area is not subject to major damage due to dam inundation from Shasta Lake Dam or any other reservoirs (Map 11, Appendix A). There is no record of sustained damage attributed to dam inundation region within the boundaries of the City and Fire District.

The Reclaimed Water Reservoir located in the City of Shasta Lake was inspected in February of 2002 and based upon the design and construction information and the visual inspection, the reservoir is considered satisfactory for continued use. The inspection included the embankment, spillway, and outlet facilities (Department of Water Resources, Division of Safety of Dams, 2002).

Seismic Activity

There are two fault lines located to the north and west of the City and Fire District region that could produce low to moderate ground shaking (Map 12, Appendix A). Ground shaking is the principal cause of damage in a seismic event and could catalyze dam failures, landslides, and fires. According to the U.S. Geological Survey (USGS), factors that affect the potential damage of structures and systems as a result of severe ground shaking include epicenter location and depth, the proximity to a fault, the direction of the rupture, the magnitude, the existing soil and geologic conditions, and the structure-type. Newer structures are more resistant to ground shaking than older structures because of improved building codes. Manufactured housing is very susceptible to damage because the foundation systems are rarely braced for seismic activity. Lifeline systems such as highways, bridges, water and gas pipelines, railroads, and utility services, can experience substantial damage from ground shaking. Structure damage is considered likely when ground motion average peak acceleration reaches 10% and 15% of gravity.

According to OES, the area is subject to low and moderate ground shaking and lies within the 10% to 30% gravity zone (Map 12, Appendix A) (OES, 2003). The region within the boundaries of the City and Fire District have not sustained damages attributed to earthquakes, dam failures, or landslides as far as records have been maintained and Shasta County has not proclaimed a state of emergency due to earthquakes events.

Volcanic Activity

Volcanic eruptions result in fires, toxic gas emissions, air pollution, extensive ash deposits, and could catalyze earthquakes, landslides, and floods. Ash deposits can create public health, telecommunications, and structure damage hazards. According to an April 2005 report published by the USGS, Mount Shasta and Lassen Peak, located in Shasta County are considered to be "very high threat volcanoes" with limited monitoring (USGS, 2005). Mount Shasta erupted with pyroclastic flows in 1786, and Lassen Peak experienced a series of small explosions in 1914 that was followed by destructive lava flows in 1915 (USGS, 2004). Although Shasta County has experienced some volcanic activity, the region within the boundaries of the City and Fire District has not sustained damages attributed to volcanic activity as far as records have been maintained. The Steering Committee did not deem it necessary to conduct a potential loss estimate to determine what is at risk from volcanic eruption in the initial version of the LHMP, however later updates should analyze the continued studies of volcanic risk and activity in the area. In their April 2005 report, the USGS proposes the highest level of monitoring, Level 4, for Mount Shasta and Lassen Peak, both of which are currently at the Level 2 monitoring stage. Monitoring includes tracking detailed changes in real-time of on-going activities such as seismic, land deformation, and gas emissions.

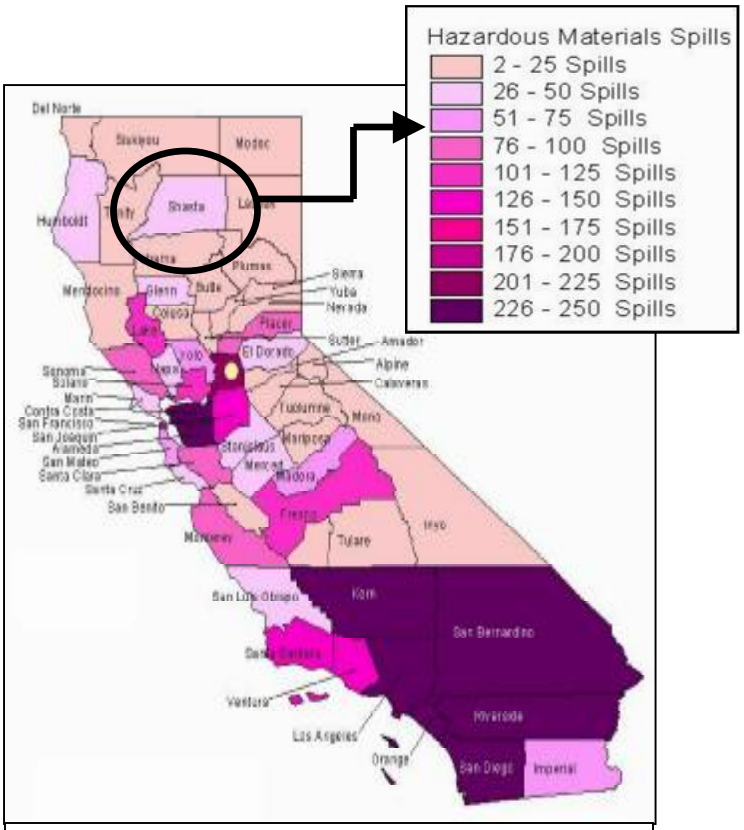
Severe Storms

Flooding and subsequent fire hazards are most often a direct result of severe storms. Severe storms can adversely impact the availability of electricity and communication lines by disrupting power lines and distribution systems.

At the end of December 2003, Shasta Lake experienced an unusual snowstorm with heavy snow and high winds that resulted in broken tree limbs, fallen telephone lines, and a heavy accumulation of debris. The

large amount of downed, suspended, and standing vegetation created a fuel hazard and left the area subject to an extreme fire threat (Fire Briefing in Appendix E). The storm was not considered severe enough to be declared a state disaster, as there was relatively little structural or building damage. According to estimates from the Fire District, the cost to recover from the storm was estimated at $200,000 to $300,000.

Hazardous Materials



Source: United States Geological Survey, 2004

According to the U.S. Department of Transportation (USDOT), a hazardous material is defined as "…a substance or material, which has been determined…capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated." Hazardous materials can be categorized as explosive, corrosive, flammable, combustible, toxic, infectious, or radioactive. A spill or burn of a hazardous material, in large enough quantity, could be an extreme threat to people, property, and the environment. The major sources of problems associated with hazardous materials are during production and use during manufacturing, a spill or a leak in a storage container, or a spill or leak during transporting. The major transportation routes for hazardous materials in Shasta County include the major highways such as Interstate 5 from Oasis Road to Wonderland Exit and State Route 151 (Shasta Dam Boulevard) from Interstate 5 to Shasta Dam as well as the railroads. Although Shasta County has experienced several hazardous spills, the City and Fire District have not sustained damage attributed to hazardous materials as far as records have been maintained.

Development Trends

The current population and residential density is heaviest in the central and southern portions of the City and Fire District boundaries (Map 13 and 14, Appendix A). The City experiences a 30-40% population increase from tourists in the spring and summer (American Red Cross Disaster Plan, 2004).

Future development can increase the risk to natural hazards and vulnerability to structural damage. Unplanned development that does not address an area's vulnerability to natural hazards can unnecessarily put people and structures in harm's way. Table 3-1 provides land use and population projections from the 1999 City of Shasta Lake General Plan.

Table 3-1
1999 General Plan Land Use and Population Projections

	Acres	Vacant	Dwelling Units	Commercial (Sq.Ft.)	Industrial (Sq. Ft.)	Population
1995 Base	6,942	3,356	3,603	1,904,225	4,528,672	9,535
General Plan	0	0	6,068	998,504	11,461,681	16,081
Subtotal	6,942	3,356	9,671	2,902,730	15,990,353	25,616
Annexation Area	842					2,280
Total	**7,785**					**27,895**

The "Annexation Area" is the area proposed by the 1999 General Plan for future annexation, should additional development occur. The "General Plan" row lists the additions that would result in ultimate build-out of the land within the City, and the area proposed for future annexation should additional development occur and result in tripling the City's population. However, in discussions with the City and Fire District staff, it was confirmed that there were no substantial changes or future facilities anticipated to develop that would represent any changes to the current land use pattern within the City and Fire District boundaries in the 5-year LHMP renewal period (see Section 5.0). If development plans for future facilities are identified and initiated through the City Planning Department or the Fire District, the structure and land use information should be incorporated into the LHMP to update the risk assessment, potential loss estimation, and mitigation measures.

Public Health Hazards

According to OES, there have been several reported cases of human West Nile Virus (WNV) infections in Shasta County. Since WNV was first isolated in 1937, it has been known to cause infection and fevers in humans in Africa, West Asia, and the Middle East. Human and animal infections were not documented in the Western Hemisphere until the 1999 outbreak in New York City. Since then, the disease has spread across the United States. In 2003, WNV activity occurred in 46 states and caused illness in over 9,800 people.

According to the USGS, WNV is transmitted to humans through mosquito bites. Mosquitoes become infected when they feed on infected birds that have high levels of the WNV in their blood. Infected mosquitoes can transmit WNV when they feed on humans or other animals, however WNV is not considered contagious from person to person (USGS, 2004).

Assessing Vulnerability: Overview

Based upon the risk assessment performed for this LHMP and recommendations from the Steering Committee, urban/wildland interface fire and flooding pose the highest risks to the City and Fire District.

Potential loss is estimated for the critical facilities, residential, and commercial properties at risk to urban/wildland interface fire and flooding. If new data qualifies any other hazards as a major hazard for the region within the annual or 5-year review and update of the LHMP, the LHMP should be updated accordingly.

Assessing Vulnerability: Identifying Assets

Critical Facilities Definition and Inventory

With the two major hazards of urban/wildland fire and flooding identified and profiled, it is necessary to evaluate how these hazards could affect the community's structural and nonstructural assets. Identifying these assets in relation to the geographic distribution of these major hazards is an integral part of the process of quantifying potential losses.

Critical facilities are considered assets and is defined by FEMA as a facility in either the public or private sector that provides essential products and services to the general public, is otherwise necessary to preserve the welfare and quality of life in the region, or fulfills important public safety, emergency response, and/or disaster recovery functions. Critical facilities located in the City and Fire District boundaries and those that are susceptible to urban/wildland fire and flooding hazards are identified in this LHMP.

According to FEMA, critical facilities include:

- **Essential Facilities** – Medical care facilities, emergency response facilities, schools, shelters, and any facility vital to emergency response and recovery following a disaster.
- **Transportation Lifeline Systems** – Highways, railways, light rail, bus systems, ports, ferry systems, and airports.
- **Utility Lifeline Systems** – Potable water, electric power, wastewater, communications, and liquid fuels.
- **Hazardous Materials Facilities** – Facilities housing industrial/hazardous materials, such as corrosives, flammable materials, radioactive materials, and toxins.

Facilities that are considered high potential loss facilities such as dams, nuclear power plants, natural gas facilities, military installations, and large unique residential or commercial structures were not evaluated for potential loss estimation in the LHMP. Table 3-2 lists the critical facilities within the City and Fire District boundaries. Map 15 in Appendix A shows the critical facilities with the corresponding number in Table 3-2.

Table 3-2
Critical Facilities

Critical Facility Number in Map 15	Type	Facility Name
1	Essential Facility - Emergency	Shasta Lake Fire Protection District Station 1
2	Essential Facility - Emergency	Shasta Lake Fire Protection District Station 2
3	Essential Facility - Emergency	Shasta Lake Fire Protection District Station 3
4	Essential Facility – Hospital/Clinics	Shasta Dam Clinic
5	Essential Facility -Hospital/Clinics	Shasta Community Health Center
6	Essential Facility – Shelter	John Beaudet Senior Community Center
7	Essential Facility – Shelter/School	Central Valley High School
8	Essential Facility – Shelter/School	Mountain Lakes High School
9	Essential Facility – Shelter/School	Shasta Lake Middle School
10	Essential Facility – Shelter/School	Grand Oaks Elementary School
11	Essential Facility – Shelter/School	Toyon Elementary School
12	Hazardous Materials Facility	Knauf Insulation
13	Hazardous Materials Facility	Professional Exterminators
14	Hazardous Materials Facility	Wesflex Pipe Manufacturing
15	Hazardous Materials Facility	Pine Grove Exxon
16	Hazardous Materials Facility	Hobbs Auto Body
17	Hazardous Materials Facility	Shasta Lake Chevron
18	Hazardous Materials Facility	Cascade Texaco Station
19	Hazardous Materials Facility	Northern Automotive
20	Hazardous Materials Facility	Buddies Auto Body

Table 3-2
Critical Facilities

Critical Facility Number in Map 15	Type	Facility Name
21	Hazardous Materials Facility	Elmer's Outboard
22	Hazardous Materials Facility	Bill Dalke's Fiberglass Repair
23	Hazardous Materials Facility	Bob's Engine Clinic
24	Hazardous Materials Facility	Sierra Pacific Industries, Inc.
25	Hazardous Materials Facility	Inter-County Termite & Pest Control
26	Hazardous Materials Facility	Walkers Custom Chrome
27	Hazardous Materials Facility	Stanley Mfg./Lumber Transport
28	Hazardous Materials Facility	Premiere Brand Meats
29	Hazardous Materials Facility	Central Valley High School
30	Hazardous Materials Facility	KMF Construction
31	Hazardous Materials Facility	John M. Frank, Inc.
32	Hazardous Materials Facility	Marvin Lachney Excavating and Paving
33	Hazardous Materials Facility	River City Construction
34	Hazardous Materials Facility	A.G. Termite Control
35	Hazardous Materials Facility	Stillwater Electric Substation
36	Hazardous Materials Facility	Central Valley Feed
37	Hazardous Materials Facility	E&J Automotive
38	Hazardous Materials Facility	Lake City Automotive
39	Hazardous Materials Facility	Snavely's Garage
40	Hazardous Materials Facility	Ron Young and Son Automotive
41	Hazardous Materials Facility	Redding Boat Works, Inc.
42	Hazardous Materials Facility	Shasta Lake Floors by Pete Corcoran & Family
43	Hazardous Materials Facility	Circle K # 2701102
44	Hazardous Materials Facility	Moto's Custom Iron Works
45	Hazardous Materials Facility	J&S Auto Parts
46	Hazardous Materials Facility	Shasta Marine Performance
47	Hazardous Materials Facility	Hardware Express
48	Hazardous Materials Facility	Surbore, Inc.
49	Hazardous Materials Facility	Pneumatics and Hydraulics
50	Hazardous Materials Facility	Cousin Gary's RV Service
51	Hazardous Materials Facility	CA-MIL, Inc.
52	Hazardous Materials Facility	Redding Yamaha Sea-Doo
53	Hazardous Materials Facility	Corporation Yard
54	Transportation Lifeline System - Highway	I-5 From Oasis Road to Wonderland Exit
55	Transportation Lifeline System - Highway	State Route 151 (Shasta Dam Boulevard) From I-5 to Shasta Dam
56	Transportation Lifeline System - Train Station	*SPRR Tunnel 1 2mi North
57	Transportation Lifeline System - Train Station	*SPRR Tunnel 2 2mi North
58	Utility/Lifeline System	Wastewater Treatment Plant
59	Utility/Lifeline System	Central Valley Substation and Corporate Yard
60	Utility/Lifeline System	Knauf Substation

Table 3-2
Critical Facilities

Critical Facility Number in Map 15	Type	Facility Name
61	Utility/Lifeline System	Sewer Pump Station No.3
62	Utility/Lifeline System	Sewer Pump Station No.4
63	Utility/Lifeline System	Relief Sewer Pump Station

Assessing Vulnerability: Estimating Potential Losses

To quantify the potential impact of urban/wildland fire and flooding to the residential, commercial, and critical facilities in the City and Fire District, the monetary potential loss was estimated using 2003/2004 parcel data from the ParcelQuest software and the Shasta County Assessor. Due to the limited number of structures in the Fire District boundary outside of the City boundary, and to remain consistent with the hazard risk assessment, the vulnerability assessment estimates the potential losses to the City and Fire District as a whole, and the parcel data is combined. The data provided is not georeferenced so it cannot be mapped in GIS, which would have allowed overlaying the hazards on the parcel data to estimate the potential loss. To circumvent this issue and to provide the most conservative potential loss for the fire and flooding hazards within the given boundaries, the road names that are within the hazards were used to determine which parcels to use for calculating the potential losses.

Due to the constraints of the data provided, potential losses are estimated for commercial and residential property only and do not include potential losses to the environment, agriculture, historical landmarks, or the potential adverse economic effects in the event of a disaster. The total number of residential and commercial structures within the City and Fire District boundaries is approximately 2,750. The losses for residential and commercial property are treated as a whole, as the data did not allow separating these two elements within the total land and improvement values. As this parcel data is updated, the LHMP will be updated with more accurate loss estimates.

Urban/Wildland Fire Loss Estimation

Residential and Commercial Urban/Wildland Fire Loss Estimation

Standard loss estimation techniques do not exist for urban/wildland fires. According to CDF, the entire

region within the City and Fire District boundaries is considered within 2,400 meters of very high wildland fire threat. Conditions such as the availability of resources to respond to a fire event, the accessibility to the structures to maneuver the available resources, prevailing wind and temperature conditions, and the maintenance work being conducted are too variable to assume a specific monetary dollar loss. The entire area is under the same level of wildland fire threat, and thereby urban/wildland fire threat. A worst-case scenario would be to consider the entire value of the 2,750 residential and commercial structures within the City and Fire District boundaries, excluding critical facilities, of approximately $189 million as a potential total monetary loss. This value does not account for content losses, functional downtime, and loss of economic activity.

Critical Facilities Urban/Wildland Fire Loss Estimation

According to CDF, the entire region is subject to very high fire threat. All of the 63 critical facilities in the region are subject to the same level of threat (Map 16, Appendix A). Parcel value information was available only for all non-exempt critical facilities (38 facilities), which excludes Utility Lifeline Systems, such as the wastewater treatment plant, pump stations, schools, and fire stations, which are not factored into the monetary potential loss estimate for critical facilities.

According to the data provided by the Shasta County Assessor and Parcel Quest, it was estimated that the total value of the 38 non-exempt critical facilities within the City and Fire District boundaries, which is the total value vulnerable to urban/wildland fire, is approximately $38 million. This does not account for content losses, functional downtime, and loss of economic activity. The potential loss to critical facilities and the additional potential loss to the residential/commercial loss previously estimated (approximately $189 million) results in a total estimated potential loss in the event of a worst-case urban/wildland fire event of approximately $227 million and is summarized in Table 3-3. As this data is updated, the LHMP will be revised with more accurate loss estimates.

Table 3-3
Total Estimated Potential Loss due to Urban/Wildland Fire

Non-exempt Critical Facilities	$38 million
Residential/Commercial	$189 million
Total Potential Loss	**$227 million**

Future Development and Critical Facilities

Members of the Steering Committee representing the City and Fire District staff confirmed that there are no substantial changes or major future facilities planned within the 5-year LHMP review period that would represent significant changes to the current land use pattern or critical facilities inventory, thus affecting the potential estimated monetary loss due to urban/wildland fire. If development plans for future facilities are identified and initiated through the City Planning Department or the Fire District, the structure and land use information should be incorporated into the LHMP to update the potential loss estimation for urban/wildland fires.

Flood Loss Estimation

Residential and Commercial Flood Loss Estimation

Based on the loss estimation methodology described earlier in this section, it was estimated that approximately 322 acres and 800 residential and commercial structures within the City and Fire District are within the 100-year FEMA-designated floodplain resulting in a total value, including improvement value and land value, of approximately $53 million (Table 3-4). This value is only for residential and commercial structures and does not include federal, state, exempt facilities, or critical facilities. It also does not reflect any infrastructure or other community elements vulnerable to damage in a flood event as well as the economic impact to agriculture or business.

Table 3-4
Estimated Total Residential and Commercial Potential Loss Due to Flooding

Approximate Improvement (Building) Value	Approximate Land Value	Approximate Total Parcel Value (Taxes excluded)	Total Acreage
$38 million	$15 million	$53 million	322

Further analysis was performed to estimate the potential loss to the 800 residential and commercial one-story, two-story, and manufactured properties, with varying Base Flood Elevations (BFE). Potential dollar losses due to flooding were calculated based upon one, two, and three feet of flooding. According to the City of Shasta Lake, approximately 87% of the homes in the City and Fire District boundaries are one-story with no basement, 5% are two-story with no basement, and 8% are manufactured homes.

Based upon these percentages, the improvement value of approximately $38 million (Table 3-4) is distributed as shown in Table 3-5.

Table 3-5
Flood-Vulnerable Residential/Commercial
Estimated Parcel Values Distributed by Structure Type

Approximate Total Improvement (Building) Value	Approximate Total One-Story Buildings with No Basement (87%)	Approximate Total Two-Story Buildings with No Basement (5%)	Approximate Total Manufactured Homes (8%)
$38 million	$33 million	$2 million	$3 million

Using the distributed values, the estimated building and contents damage due to flooding at one, two, and three feet flood depth are presented in Table 3-6.

Table 3-6
Flood Loss Estimation

Flood Depth	One-Story No Basement (Approximate Total Value = $33 million)				
	(% Building Damage)*	Building Damage	(% Contents Damage)*	Contents Damage	Totals
1	14	$4.6 million	21	$6.9 million	$11.5 million
2	22	$7.3 million	33	$10.9 million	$18.2 million
3	27	$8.9 million	40.5	$13.4 million	$22.3 million
Flood Depth	**Two Story No Basement (Approximate Total Value = $2 million)**				
1	9	$180,000	13.5	$270,000	$450,000
2	13	$260,000	19.5	$390,000	$650,000
3	18	$360,000	27	$240,000	$600,000
Flood Depth	**Manufactured Home (Approximate Total Value = $3 million)**				
1	44	$1.3 million	66	$2 million	$3.3 million
2	63	$1.9 million	90	$2.7 million	$4.6 million
3	73	$2.2 million	90	$2.7 million	$4.9 million

**Percent Building and Content Damage provided by FEMA's State and Local Mitigation Planning How-To Guides*

The largest monetary loss would occur for one-story buildings because they represent the largest percentage of the total value in the floodplain and the building and content loss would also be higher than the two-story structures. Manufactured homes would suffer the greatest percentage of loss to the structure and contents; however, the total cumulative value of the structures is less than that of the one-story and would withstand less total monetary damage. Based on the estimate, the two-story structures would have lower building and contents loss.

Parcel data used in the potential losses estimate does not specify the structure use, which would have been used to estimate the cost for functional downtime and displacement. Therefore, the estimate provided herein does not account for downtime and displacement and would be even higher if these elements were included. As more detailed parcel data becomes available, the LHMP would be updated accordingly.

Based upon data provided by FEMA, there is only one property within the City and Fire District that has been reported to have sustained damages due to flooding (Map 17, Appendix A).

Critical Facilities Flood Loss Estimation

There are six critical facilities located in the FEMA-designated 100-year floodplain (Table 3-7). Critical facilities and the FEMA-designated floodplains are provided on Map 18, Appendix A.

Table 3-7
Critical Facilities in the FEMA 100-Year Floodplain

Critical Facility Type	Critical Facility	Address
Hazardous Materials	Snavely's Garage	4420 Shasta Dam Blvd.
Hazardous Materials	Cousin Gary's RV Service	3165 Twin View Blvd.
Hazardous Materials	Circle K #2701102	4833 Shasta Dam Blvd.
Hazardous Materials	Pine Grove Exxon	2725 Cascade Blvd.
Hazardous Materials	CA-MIL, Inc.	3035 Twin View Blvd.
Hazardous Materials	Redding Yamaha Sea-Doo	3119 Twin View Blvd.
Total Approximate Parcel Value (Taxes Excluded)		**$2.1 million**

The total estimated potential loss to critical facilities due to flooding is over $2 million. The potential loss to critical facilities would be an additional potential loss to the residential/commercial loss previously estimated (Approximately $38 million). The total estimated potential loss in the event of a flood is approximately over $40 million and is summarized in Table 3-8. As this data is updated, the LHMP would be updated with more accurate loss estimates.

Table 3-8
Total Estimated Potential Loss Due to Flooding

Critical Facilities	$2.1 million
Residential/Commercial	$38 million
Total Potential Loss	**$40.1 million**

Future Development and Critical Facilities

Members of the Steering Committee representing the City and Fire District staff confirmed that there are no substantial changes or major future facilities planned within the 5-year LHMP review period that would represent significant changes to the current land use pattern or critical facilities inventory, thus affecting the potential estimated monetary loss due to flooding. If development plans for future facilities are identified and initiated through the City Planning Department or the Fire District, the structure and land use information should be incorporated into the LHMP to update the potential loss estimation for flooding.

SECTION 4.0 MITIGATION MEASURES

Regardless of the extent and cost of mitigation measures implemented for a natural hazard, some level of risk would remain. Emergency response, system enhancement, and engineering strategies could be implemented to reduce the impacts of a natural hazard event; however, each mitigation measure would have an implementation cost and residual risk. If nothing is done, there are no implementation costs, but the residual risk may be unacceptably high. An aggressive hazard mitigation approach would have excessively high implementation costs but the residual risk would be small. What is considered a high implementation cost and an unacceptably high residual risk depends upon economic, legal, social, technical, administrative, environmental, and political considerations. Acceptable risk is that level established by the City and Fire District at which additional costs to further reduce losses and risks are no longer feasible. The process to make this determination differs among governing agencies and must be realized when determining which mitigation actions to implement.

Based upon the risk assessment, the City and Fire District are the most vulnerable to the following:

- Urban/wildland interface fire due to increasing development.
- Severe weather (thunderstorms, rain, snow, and hail, constitute a significant on-going threat to the extent they cause a secondary hazard, such as increasing the fire fuel load).
- Localized flooding (due to inadequate drainage and maintenance).

Mitigation Goals and Actions

Mitigation goals and actions to consider for reducing risks caused by natural hazards are presented below. The mitigation goals provide general guidelines that identify the long-term hazard mitigation target and the actions assign strategies to implement to attain these goals. All of the mitigation goals and actions include the City and Fire District region as a whole, due to the major geographic overlap between the two entities. As a result, there are no recommended actions that are specific to any jurisdiction at this time; however, if needed, this could be revised at the annual or 5-year review period. At this initial version of the LHMP, the goals and actions address the two major hazards of urban/wildland fire and flooding.

Mitigation Goals and Actions Summary

The following are the goals identified for the LHMP and the actions needed to accomplish them. For each action item the lead agency or individual responsible for implementation is listed. Detailed cost estimates and schedules for each action required will be completed at the time of implementation of these actions, however potential sources of funding are identified and the implementation schedule for each action is designated as short-term (two years or less), and long-term (two years or more).

GOAL 1: PROTECT PEOPLE AND PROPERTY FROM FIRE AND FLOOD HAZARDS

Actions Required:

1-A Utilize the Fire Risk Assessment and Management Strategies (RAMS) Program

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.

Schedule: Short-term.

1-B Establish Fuel Breaks

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.

Schedule: Short-term.

1-C Establish and Maintain a Fire Fuel Management Plan

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.

Schedule: Short-term.

1-D Establish a Fire Safe Council

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal grants.

Schedule: Short-term.

1-E Incorporate Fire Hazard Potential in the City General Plan

Lead Agency/Individual: City of Shasta Lake Planning Department Manager and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term (During the General Plan Update or during a re-evaluation of the fire hazard potential).

1-F Develop and Adopt a Maintenance Plan for Streams and Channels

Lead Agency/Individual: City of Shasta Lake Public Works Department Director.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

1-G Increase Culvert and Bridge Capacity at Hilltop Circle Crossing on Churn Creek and the Interstate 5 Crossing on Moody Creek

Lead Agency/Individual: City of Shasta Lake Manager.

Cost Estimate/Potential Resources: Federal and state funding.

Schedule: Long-term.

1-H Provide Early Warning of Life-Threatening Hazards

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal grants and general funds.

Schedule: Long-term.

1-I Develop an Emergency Response Plan for the Region, Including Evacuation and Rescue Routes

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal funding and City of Shasta Lake general funds.

Schedule: Long-term.

1-J Submit Mitigation Project Applications Annually (at a Minimum)

Lead Agency/Individual: City of Shasta Lake Manager.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

GOAL 2: INCREASE PUBLIC AWARENESS OF THE NATURAL HAZARDS

Actions Required:

2-A Refer to the LHMP and Include Pertinent Elements of the LHMP into the City's General Plan and the Fire District's Fire Protection Plan

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

2-B Make Current Hazard Map Information Available Through the City and County Websites and Maintain Hazard Database

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

2-C Increase Public Awareness of Potential Hazards of the Area and Provide Information on Safety and Health Precautions

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

2-D Ensure Real Estate Disclosure

Lead Agency/Individual: City of Shasta Lake Manager.

Cost Estimate/Potential Resources: General funds.

Schedule: Long-term.

2-E Keep the City Library Current With Up-To-Date Hazard Data Information

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

2-F Organize and Participate in Educational Programs That Address Natural Hazards in the Area

Lead Agency/Individual: City of Shasta Lake Manager and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

2-G Improve Coordination Between Agencies, Environmental Groups, and Developers and Coordinate with Neighboring Communities to Minimize and Mitigate Hazards

Lead Agency/Individual: City of Shasta Lake Planning Department Manager and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

Mitigation Goals and Actions

GOAL 1: PROTECT PEOPLE AND PROPERTY FROM FIRE AND FLOOD HAZARDS

Action 1-A: Utilize the Fire Risk Assessment And Management Strategies (RAMS) Program

To improve the current fire risk assessment and management system and reduce the vulnerability to wildland fires within the region, the Fire District could install and operate the Risk Assessment and Mitigation Strategies (RAMS) program developed by the U.S. Department of Interior, Bureau of Land Management, and National Interagency Fire Center. RAMS provides a consistent process for developing prevention and fuels management programs. RAMS allows users to prioritize areas within its planning unit, consider various prevention and/or fuels treatment alternatives, and to develop a budget. RAMS includes three components:

- Assessment tools to identify the highest priority areas in which to consider fuels and/or prevention work.
- A Fire Prevention module that allows users to develop one or more fire prevention options with costs and work details.
- A Fuels Analysis that identifies potential fuel treatment strategies and projects.

A final report printed from RAMS shows any or all of the assessment, prevention, or fuels work completed. This program and its user manual are available online at no charge at: http://www.nifc.blm.gov/nsdu/fire_planning/rams/index.html.

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.
Schedule: Short-term.

Action 1-B: Establish Fuel Breaks

Fuel breaks are wide strips of land where trees and vegetation have been permanently reduced or removed to provide a barrier between development and fire hazards. The size can range from stretches of open land to protect subdivisions, to a clearing around a residential structure, and can include parks, golf courses, and roads. These areas slow and even stop the spread of a wildland fire because they provide fewer fuels to carry the flames. They also provide firefighters with safe zones to use when fighting wildfires.

In accordance with the Shasta-Trinity Unit 2004 Fire Plan recommendations to reduce the risk to urban/wildland fire to the region within the City and Fire District boundaries, the LHMP recommends implementing roadside fuel treatment, which includes thinning brush or timber and mowing and treating grasses located along the roadside edge. Due to the ease of access along roadways, it is considered easier and cheaper to construct fuel breaks in these areas. This would prevent high intensity fires from spreading. Fuel breaks should also be placed strategically along ridge-tops or between brush fields and timberlands to help confine wildfires. Fuel breaks could be required in development plans, as is currently done with retention basins, and would require coordination by the City manager with the City's Department of Development Services, the City General Plan, and the Fire District. Fuel breaks could also be incorporated as a strategy in a Fire Fuel Management Plan for the region within the boundaries of the City and Fire District.

Off of Pine Grove Road, mitigation effort underway by CDF Crew, Shasta Lake, CA. Photo taken August 3, 2004.

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.
Schedule: Short-term.

Action 1-C: Establish and Maintain a Fire Fuel Management Plan

Following the December 2003 storm, over 70,000 acres of public and private land had significantly increased fuel loads due to fallen and suspended debris. These areas were identified in a briefing published by the CDF on June 1, 2004, and included the entire area within the City and Fire District boundaries (a copy of the briefing is provided in Appendix E). These areas require increased debris clean up and maintenance to decrease the fuel load and thereby decrease the fire fuel hazard. A Fire Fuel Management Plan that identifies fire fuel hazard areas could be developed, maintained, and implemented.

Off of Pine Grove Road, mitigation effort underway by CDF, Shasta Lake, CA. Photo taken August 3, 2004.

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: Federal grants, state grants, and general funds.
Schedule: Short-term.

Action 1-D: Establish a Fire Safe Council

Members of the City and Fire District have recognized that a Fire Safe Council could assist in reducing the risk of wildland fire through public awareness and participation. A volunteer Fire Safe Council would promote fire hazard public awareness, facilitate fire mitigation activities, and ensure community involvement. Detailed guidance for the start-up, methods to improve and maintain participation, and a process to meet the objectives of a local Fire Safe Council is provided in Appendix D.

Lead Agency/Individual: Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: Federal grants.
Schedule: Short-term.

Action 1-E: Incorporate Fire Hazard Potential in the City General Plan

In accordance with the 2004 Shasta-Trinity Unit Fire Plan and to reduce the vulnerability of urban/wildland fire, the City's 1999 General Plan should be updated to include increasing building distances from property lines to create defensible space and ensure that the type of construction and construction materials used for structures are conducive to fire defensibility. Defensible space is the area between a house and an on-coming wildfire where the vegetation has been modified to reduce the wildfire threat and to provide an opportunity for firefighters to effectively defend the house. Sometimes, a defensible space is simply a homeowner's properly maintained backyard. Before an urban/wildfire threatens, the following personal property techniques should be considered:

- Design and landscape homes with wildfire safety in mind.
- Select materials and plants to help contain fire rather than fuel it.
- Use fire resistant or noncombustible materials on the roof and exterior structure of the dwelling.
- Plant fire-resistant shrubs and trees.

According to the 2004 Shasta-Trinity Unit Fire Plan, greenbelts created when subdivisions are developed in the wildland areas can often contain extremely flammable fuel conditions. Fuel maintenance standards should be considered for greenbelts in future and existing developments, and the General Plan should be updated accordingly.

Lead Agency/Individual: City of Shasta Lake Planning Department Manager and the Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term (During the General Plan Update or during a re-evaluation of the fire hazard potential).

Action 1-F: Develop and Adopt a Maintenance Plan for Streams and Channels

The City identified areas of frequent flooding that occur primarily at road crossings due to local drainage issues (Map 6, Appendix A). The local runoff tributary to these culverts as well as the adequacy of conveyance of these culverts cannot be evaluated without more detailed hydrologic and topographic information, however, in general, it is assumed that using larger culvert sizes and implementing a channel maintenance program at the upstream and downstream faces of these crossings would provide the necessary capacity to alleviate high recurrence flooding.

Culvert at intersection of Mussel Shoals and Front Street, Shasta Lake, CA. Photo taken on August 3, 2004.

Currently, only six utility workers in the City Department of Public Works perform drainage system maintenance, such as inspections and debris clearing. A formal maintenance plan with a procedure for maintaining the drainage systems in the City and Fire District's boundaries would lower the amount of flooding that results from localized drainage blockage in a heavy storm. A maintenance plan should include an evaluation of the current drainage system, written procedures, and a maintenance plan implementation, monitoring, evaluation, and update procedure. A maintenance plan would qualify as credit under the FEMA NFIP Community Rating System (CRS) program, which qualifies NFIP participants for reductions in flood insurance premiums.

Lead Agency/Individual: City of Shasta Lake Public Works Department Director.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

Action 1-G: Increase Culvert and Bridge Capacity at Hilltop Circle Crossing on Churn Creek and the Interstate 5 Crossing on Moody Creek

In the FEMA FIS for Shasta County, there are two residential areas that are subject to inundation from split flow during a 100-year storm event. These areas include:

- The Hilltop Circle crossing on Churn Creek (in the Twin Lakes Mobile Home Park), where the four 4-ft by 4-ft box culverts do not provide adequate conveyance of the 100-year flow, which leads to shallow flooding in the areas adjacent to the crossing.

- The Interstate 5 crossing on Moody Creek, where the existing pair of 9.5-foot-diameter culverts do not have capacity to convey the 100-year storm. During the 100-year storm, water backs up behind the highway and Shasta Dam Boulevard, eventually overtopping Shasta Dam Boulevard and spilling southward parallel to Shasta Street and Cascade Boulevard.

A major constraint at the Hilltop Circle crossing on Churn Creek is that the channel slope is fairly shallow, which requires relatively large increases in conveyance capacity to influence the water surface elevation in the channel. Wood Rodgers imported the FIS Hydrologic Engineering Center (HEC) HEC-2 model for Churn Creek into the U.S. Army Corps of Engineers (USACOE) Hydrologic Engineering Center River Analysis System (HEC-RAS) and determined over the course of several modeling iterations that to ensure that spill does not occur during the 100-year event, the existing crossing would need to be modified to accept an additional five 4'x4' box openings and the channel upstream and downstream of the crossing would need to be widened about 25 feet. An alternative that could provide an equivalent level of flood protection for the overbank would be to construct a floodwall. With either of these improvements, the roadway is still overtopped and a great deal of overland conveyance is required near the bridge.

To mitigate the flooding condition at the Interstate 5 crossing on Moody Creek, the capacity of the Interstate 5 crossing could be increased. Wood Rodgers imported the FIS HEC-2 model for Moody Creek into HEC-RAS and determined over the course of several modeling iterations that adding a single 102-inch-diameter Reinforced Concrete Pipe (RCP) would be sufficient to convey the 100-year storm without spilling over Shasta Dam Boulevard. Increasing the conveyance capacity of the crossing results

in generally higher downstream water surfaces. Implementing this improvement would likely involve a bore and jack operation so as not to disrupt the utility of the highway and would cost approximately $1.3 million.

In addition, Wood Rodgers considered constructing a floodwall as an alternative to increasing the crossing conveyance at this location; however, shutting off the split flow without increasing the existing crossing capacity results in inundation of the highway as well as an increase of two feet in the water surface elevation upstream of the crossing. More detail about these analyses is presented in Appendix F.

Lead Agency/Individual: City of Shasta Lake Manager.
Cost Estimate/Potential Resources: Federal and state funding.
Schedule: Long-term.

Action 1-H: Provide Early Warning of Life-Threatening Hazards

Emergency management is a vital element to reducing the risk to life and property in the event of a disaster. If residents are notified in advance and a planned evacuation and shelter route is established, the vulnerability of people and property to fire and flooding is reduced by allowing fire and flood-fighting efforts to more efficiently mitigate the hazards and keep people out of harm's way. Emergency management involves early warning, evacuation, response, hazardous materials protection, and recovery.

The Emergency Response Chart (Figure 4-1) illustrates the current City Emergency Operations system. Generally, initial emergency notification would come through a citizen 911 telephone call. The chain of communication from this point as illustrated on the Emergency Response Chart depends upon whether the call is placed from a landline or a cellular phone. Response involves the California Highway Patrol, Animal Control, the County Sheriff, Emergency Medical Services, CDF, the Fire District, and the City. In the event that other entities were notified of an emergency in the area before a citizen telephone call, they would contact the proper agency according to the Emergency Response Chart.

EMERGENCY RESPONSE CHART

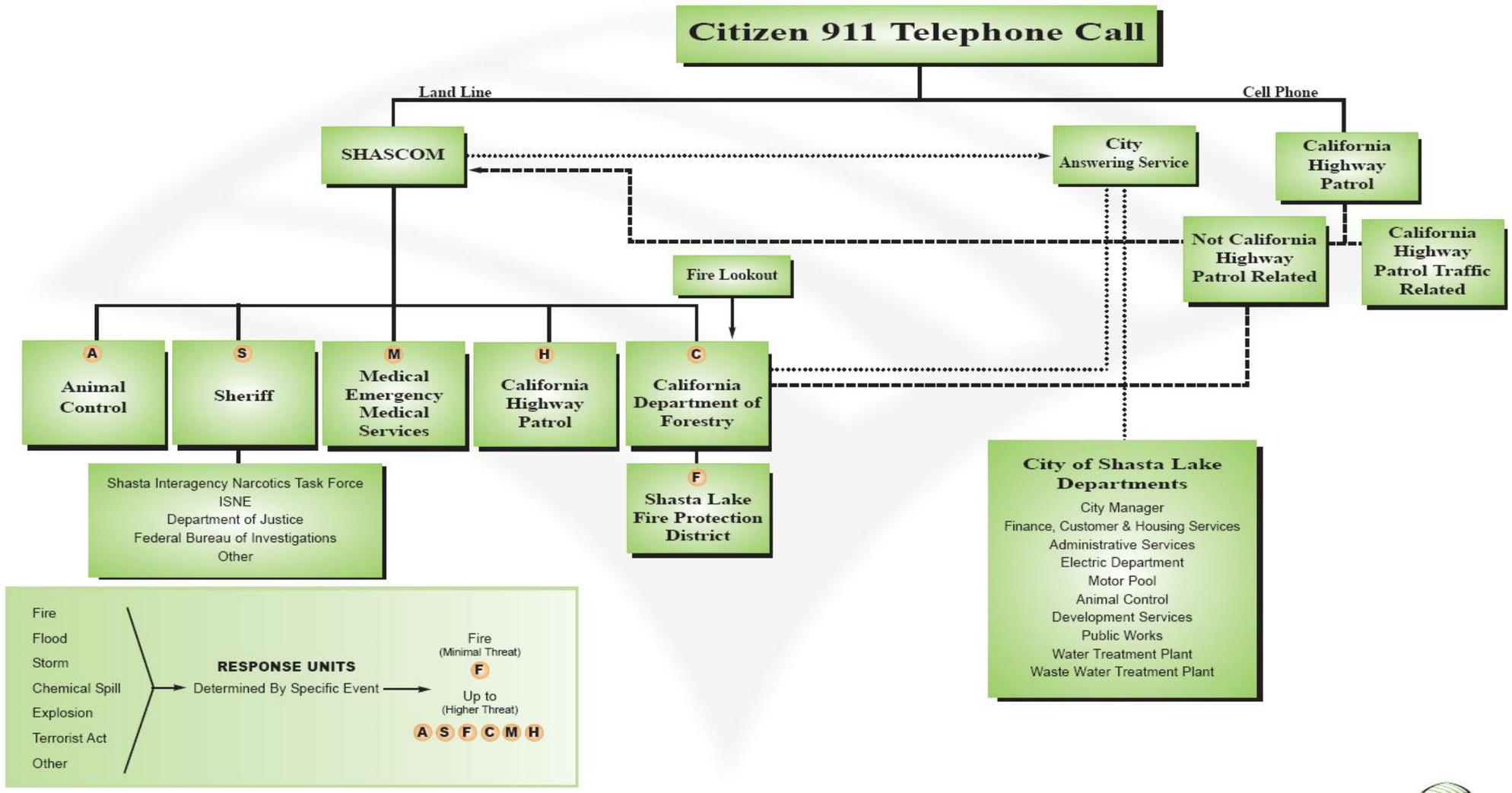


Figure 4-1 Emergency Response Chart

Achieving the National Weather Service (NWS) "Storm-Ready" certification for the City and Fire District would be useful. Certification involves redundant methods of communicating warnings (Emergency Alert System, Flood Alert, outdoor siren, cable television override), NOAA "Weather Radio" reception in all portions of the County, NOAA weather radios in all government buildings and schools, and an understanding of NWS capabilities and procedures, which would include NWS training, formation of "Weather Spotter" groups, and coordination between the County OES and NWS. NOAA Weather Radio is becoming a standard in the nation's all-hazard warning infrastructure and is planned for use in conjunction with Homeland Security.

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: Federal grants and general funds.
Schedule: Long-term.

Action 1-I: Develop an Emergency Response Plan for the Region, Including Evacuation and Rescue Routes

During the most recent fire event in August 2004, the City and Fire District were able to assist the County in putting out fires by successfully mobilizing resources and personnel, proving that the current emergency response system is effective. Each of the departments in the City and County has its own emergency response procedures and currently coordinate with each other in the event of an emergency. Table 4-1 lists these departments and the responsibilities of each.

Table 4-1
Emergency Operation Roles

Agency	Role
Director of Emergency Services	**Manage Emergency Operations** – Provides the overall management and coordination of emergency operations.
Fire Chief	**Fire and Rescue Operations** – Provides emergency medical care and rescue of persons, helps reduce fire threat.
Sheriff/California Highway Patrol	**Law Enforcement and Traffic Control Operations** – Enforces applicable laws, orders, and regulations and provides traffic control on designated highways, streets, and roads.
Emergency Medical Services Officer	**Medical Operations** – Provides care and treatment for the injured during a disaster.

Table 4-1
Emergency Operation Roles

Agency	Role
Emergency Medical Services Officer	**Public Health Operations** – Provides public health and environmental sanitation services.
Shasta County Offices of Emergency Services/American Red Cross	**Care and Shelter Operations** – Provides basic needs for residents.
Sheriff's Office	**Movement Operation** – Provides evacuation and relocation of persons from threatened or affected areas. The Incident Command System used by the Shasta County Sheriff's Office includes an Incident Commander that is responsible for incident activities including developing and implementing strategic decisions and approving the order and release of resources.
Shasta County Office of Emergency Services	**Rescue Operations** – Carries out coordinated search and rescue operations for the location, provides immediate care, and safe removal of endangered, entrapped, injured and/or isolated persons.
Public Works	**Construction and Engineering Operations** – Provides for the procurement, distribution, and use of construction and engineering resources.
Finance Director	**Resources and Support Operations** – Provides for the procurement and distribution of essential resources and services (including equipment, supplies, water, food, electric power, and transportation).
Source: City of Shasta Lake Emergency Plan	

To maintain the efficiency of the current emergency management system and thereby reduce the vulnerability to the urban/wildland fire and flooding hazard in the region, the system should be maintained, updated, and tested on a consistent basis.

As part of the emergency management system, coordination of shelters is an important element. In the event of a major urban/wildland fire and flooding hazards event, coordinating shelter resources efficiently is essential to reducing the risk to lives. The Shasta Area Red Cross Chapter is centrally located in Redding. In the event of a disaster in Shasta County, the Shasta County Director of Emergency Services (the County Sheriff) or the County Fire Department notifies the Shasta Area Red Cross Chapter. The Emergency Services Director of the Red Cross Chapter would ensure the deployment of appropriate chapter personnel to meet the immediate needs of those affected by the disaster. A Red Cross "Disaster Action Team" (DAT) would be deployed to assess the situation, provide service, commence liaison, and request additional support as determined necessary by the assessment of the scope and size of the incident (American Red Cross, 2004). In a major disaster, the Red Cross Chapter would collaborate with

emergency management, other volunteer agencies, and community-based organizations to determine the best way to serve those affected by the disaster. If the demands of the disaster exceed the resources of the chapter, appropriate requests would be initiated to the zone, state, or national headquarters to support the disaster relief operation (American Red Cross, 2004). Shelters located in the City and Fire District region are listed in the Table 4-2 and included on Map 19, Appendix A.

Table 4-2
Shelters

Shelter	Address	Telephone
Central Valley High School	4066 La Mesa	530-275-7075
Shasta Lake Middle School	4620 Vallecito	530-275-7020
Mountain Lakes High School	4425 Main St	530-275-7000
John Beaudet Senior Center	1525 Median Ave	530-275-7473
Toyon Elementary School	17752 Shasta Dam Blvd.	530-275-7050
Grand Oaks Elementary School	5309 Grand Ave.	530-275-7040

Another mitigation component of the emergency management system is ensuring that facilities containing hazardous materials are properly evacuated and that flood and urban/wildland fire hazards do not exacerbate the hazard. Hazardous materials can worsen the affect of a major disaster and aggravate emergency rescue and evacuation response. Knowing the locations of facilities that contain hazardous materials as well as ensuring established evacuation routes within the facilities could assist in protecting people and facilities from urban/wildland fire and flooding hazards during evacuation and response.

All facilities located in the City that contain hazardous materials at or above 55 gallons for liquids, 500 pounds for solids, or 200 cubic feet for compressed gases must have Business Plans as of April 2004, which are required by the Shasta County Environmental Health, Hazardous Materials Management Division. Business Plans for these facilities provide the description and the location of the hazardous materials on site, as well as evacuation routes for staff at the site. Evacuation routes are prominently displayed throughout the facilities and evacuation notification is conducted by horns, sirens, or verbally. Sites with approved Business Plans include:

- The City of Shasta Lake Water Treatment Plant, located on Lake Boulevard
- The City of Shasta Lake Corporate Yard and Central Valley Substation, located on Vallecito Street

- The City of Shasta Lake Wastewater Treatment Plant, located on Tibbits Road
- The City of Shasta Lake Knauf Substation, located on Ashby Road
- The City of Shasta Lake Flanagan Substation, located on Ashby Road
- The City of Shasta Lake Sewer Pump Station No.4, located on Tibbits Road
- The City of Shasta Lake Sewer Pump Station No.3, located on Cascade Boulevard
- The City of Shasta Lake Relief Pump Station, located on Pine Grove Avenue

In the event of an emergency, all hazardous material sites would plan evacuation and response according to these Business Plans. If the scale of the emergency encompasses a larger area than the hazardous materials facility site, the evacuation and response would be incorporated into the City and Fire District emergency operations. Other sites that contain hazardous materials are included in Table 4-3, with corresponding emergency contacts listed.

Table 4-3
Hazardous Materials Facilities

Business Name	Business Street Name	Business Type	Business Telephone	Business Fax	Website / E-Mail
Knauf Insulation	3100 Ashby Road	Manufacturing/Industrial	530-275-9665	530-275-4993	N/A
Professional Exterminators	4373 Autumn Harvest Way	Termite and Pest Control	530-276-9649	530-275-1765	proext@msn.com
Wesflex Pipe Manufacturing	3410 Bronze Court	Manufacturing	530-275-9400	530-275-9700	wesflex@aol.com
Pine Grove Exxon	2725 Cascade Blvd.	Gas Station / Mini Mart	530-275-5003	N/A	N/A
Hobbs Auto Body	1807 Cascade Blvd.	Auto Body Repair and Paint	530-275-8621	530-275-4135	N/A
Shasta Lake Chevron	1666 Cascade Blvd.	Service Station, Mini Mart	530-275-1073	530-275-9194	N/A
Cascade Texaco Station	1725 Cascade Blvd.	Service Station, Mini Mart	530-275-2775	530-275-2775	N/A
Northern Automotive	1661 Cascade Blvd.	Automotive Repair	530-528-9133	N/A	N/A
Buddies Auto Body	2012 Cascade Blvd.	Automotive Body Repair	530-275-4953	530-275-4953	N/A
Elmer's Outboard	1965 Cascade Blvd.	Outboard and Inboard Outboard Repair and Service	530-275-3740	N/A	N/A

Table 4-3
Hazardous Materials Facilities

Business Name	Business Street Name	Business Type	Business Telephone	Business Fax	Website / E-Mail
Bill Dalke's Fiberglass Repair	1965 Cascade Blvd.	Fiberglass Repair - Marine	530-275-8865	N/A	N/A
Bob's Engine Clinic	2900 Cascade Blvd.	Small Engine and Garden Equipment Sales and Repair	530-275-2190	530-275-2692	N/A
Sierra Pacific Industries, Inc.	3755 El Cajon Ave.	Lumber Manufacturing	530-275-8851	530-275-0373	N/A
Inter-County Termite & Pest Control	4060 Fort Peck Street	Structural Pest Control	530 275-4499	530-275-9131	N/A
Walkers Custom Chrome	2145 Grand Coulee Blvd.	Electroplating & Polishing	530.275.3634	N/A	N/A
Stanley Mfg./Lumber Transport	4401 Indian Avenue	Manufacturing	530-275-3349	530-275-2501	N/A
Premiere Brand Meats	3555 Iron Court	Meat Processor	530-275-4500	N/A	N/A
Central Valley High School	4066 La Mesa	School			
KMF Construction	13980 Linda Vista Dr.	General Construction	530-275-1685	530-275-0706	kmf@snowcrest.net
John M. Frank, Inc.	13760 Montego Drive	General Construction	530-275-1685	530-275-0706	kmf@snowdrest.net
Marvin Lachney Excavating and Paving	5013 Red Bluff Street	Excavation, Grading and Asphalt Paving	530-275-2279	530-275-8824	N/A
River City Construction	4490 Riddle Rd.	Construction, Grading, Paving, Excavation	530-275-1998	530-275-8370	N/A
A.G. Termite Control	5316 Second St.	Structural Pest Control	530-275-5350	N/A	
Stillwater Electric Substation	Second Street	Electric Substation			
Central Valley Feed	4670 Shasta Dam Blvd.	Retail Sales of Farm Animal and Pet Supplies	530-275-5992	N/A	N/A
E&J Automotive	4309 Shasta Dam Blvd.	Automotive Repair	530-275-3566	N/A	N/A
Lake City Automotive	4612 Shasta Dam Blvd.	Auto Repair	530-275-8841	N/A	N/A
Snavely's Garage	4420 Shasta Dam Blvd.	Automotive Repair	530-275-1515	N/A	N/A
Ron Young and Son Automotive	3657 Shasta Dam Blvd.	Automotive Repair	530-275-8879	N/A	N/A

Table 4-3
Hazardous Materials Facilities

Business Name	Business Street Name	Business Type	Business Telephone	Business Fax	Website / E-Mail
Redding Boat Works, Inc.	4633 Shasta Dam Blvd.	Boat Sales / Repair; Motors, Parts, Accessories; Boat Trailers.	530-275-1495	530-275-1852	reddingboatworks@c-zone.net
Shasta Lake Floors by Pete Corcoran & Family	4052 Shasta Dam Blvd.	Floor Covering Retail	530-275-8530	530-275-8944	shastalakefloors@aol.com
Circle K # 2701102	4833 Shasta Dam Blvd.	Convenience Store	530-275-2883	602-728-8610	N/A
Moto's Custom Iron Works	3787 Shasta Dam Blvd.	Welding - Fabrication	530-275-2952	530-275-4976	N/A
J&S Auto Parts	4512 Shasta Dam Blvd.	Auto Parts and Accessories	530-275-1527		
Shasta Marine Performance	3912 Shasta Dam Boulevard	Marine Service and Repair	530-604-8283	N/A	info@shastamarineperformance.com
Hardware Express	4236 Shasta Dam Boulevard	Hardware/Household Supplies	530-275-1721		
Surbore, Inc.	3400 Shasta Gateway Dr., # I	Machine Shop	408-293-0197	408-971-2802	N/A
Pneumatics and Hydraulics	3400 Shasta Gateway Dr., #C	Sales and Service	530-275-2186	N/A	N/A
Cousin Gary's RV Service	3165 Twin View Blvd.	RV Parts and Service Sales	530-275-6089	530-275-6281	N/A
CA-MIL, Inc.	3035 Twin View Blvd.	Trucking, Semi Trailer Sales and Skylight Sales	530-275-4080	530-275-4066	N/A
Redding Yamaha Sea-Doo	3119 Twin View Boulevard	Motorcycle Retail	530-275-7300	530-275-7310	N/A
Corporation Yard	4332 Vallecito Street	Auto Shop/Electrical Transformers	530-275-7491		

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: Federal funding and City of Shasta Lake general funds.

Schedule: Long-term.

Action 1-J: Submit Mitigation Project Applications Annually, at a Minimum

Maximizing the use of available funding will ensure that mitigation actions used to alleviate the vulnerability to flooding and urban/wildland fire are implemented. FEMA currently has five hazard mitigation funding programs that are useful for the proposed mitigation actions in this LHMP. A brief description of the five programs is given below.

Hazards Mitigation Grant Program (HGMP)

The HMGP provides grants to states and local governments to implement long-term hazard mitigation strategies after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to implement mitigation strategies during the recovery from a disaster declaration. HMGP funding is only available in states following a Presidential disaster declaration. Eligible applicants include state and local governments, Indian tribes or other tribal organizations, and certain private non-profit organizations.

Individual homeowners and businesses may not apply directly to the program, however a community may apply on their behalf. Proposed projects must provide a long-term solution to a problem, for example, elevating a home to reduce the risk of flood damage as opposed to buying sandbags and pumps to fight the flood. The project's potential savings must be more than the cost of implementing the project. Funds awarded may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage (FEMA, 2004).

Pre-Disaster Mitigation Program (PDM)

The PDM provides technical and financial assistance to states and local governments for cost-effective pre-disaster hazard mitigation activities that complement a comprehensive mitigation program and reduce injuries, loss of life, and damage and destruction of property. FEMA provides grants to states and federally-recognized Indian tribal governments that, in turn, provide sub-grants to local governments for mitigation activities such as planning and implementing projects identified through the evaluation of natural hazards. The FY 2003 PDM funding was nearly $150 million nationally; almost $250,000 for each state.

Flood Mitigation Assistance Program (FMA)

FMA provides funding to assist states and communities in implementing strategies to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. There are three types of grants available under FMA: Planning, Project, and Technical Assistance. FMA Planning Grants are available to states and communities to prepare Flood Mitigation Plans. NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project Grants. Funding for the program is provided through the National Flood Insurance Fund, and FMA is funded $20 million nationally. States and communities are encouraged to develop plans that address the mitigation of target repetitive loss properties (FEMA, 2004).

Fire Management Assistance

Fire Management Assistance, authorized by the Stafford Act and amended by the Disaster Mitigation Act of 2000, assists states, Indian tribal governments, and local governments for mitigating, managing, and controlling any fire burning on publicly (non-federal) or privately-owned forest or grassland, which would constitute a major disaster. FEMA federal fire management assistance is provided through the President's Disaster Relief Fund and is used to assist in fighting fires that threaten to cause a major disaster. The fire management assistance pays 75% of a state's eligible firefighting and emergency response costs under an approved grant for managing, mitigating, and controlling designated fires. Eligible state firefighting costs covered by the aid can include expenses for field camps; equipment use, repair and replacement; tools, materials and supplies; and mobilization and demobilization activities.

Public Assistance Program (PA)

The PA program provides funding, following a disaster declaration, for repairing, restoring, or replacing damaged facilities belonging to governments and to private nonprofit entities, and for other associated expenses, including emergency protective measures and debris removal. The federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The state determines how the non-federal share (up to 25%) is distributed to the applicants. For small projects (under $50,000), the grant is based upon an estimate of the cost of the work. For large projects ($50,000 or more), the final grant is based upon actual eligible costs. In large projects, the state would disburse progress payments, as required (FEMA, 2004).

The LHMP provides a mechanism for OES to provide technical assistance to local communities and to track the progress and effectiveness of local government mitigation planning programs. As part of the program, the state established the following criteria for prioritizing local mitigation activities for funding:

- Percent of population at risk.
- Frequency and likelihood of hazard.
- Repetitive loss areas.
- Small/impoverished communities.
- Planning resources available.
- Types/percent of land areas at risk.
- Development pressure rating.
- Project urgency and cost/benefit analysis.
- Cost effectiveness of measure.

To take advantage of the opportunity to implement the proposed mitigation actions, which will reduce the vulnerability of urban/wildland fire and flooding to the region within the City and Fire District, staff designated by the City and Fire District should periodically research and apply for mitigation grant funding.

Currently, there are no local funding mechanisms, such as taxes, fees, assessments, or fines that affect or promote mitigation within the City and Fire District boundaries. Other than the City's participation in the NFIP, there are no existing local ordinances that significantly affect or promote disaster mitigation, preparedness, response, or recovery. Natural hazard mitigation programs, efforts, and entities currently in place that could assist the City and Fire District which mitigation efforts include CDF, DWR's Awareness Mapping program, the California Dam Safety Program, the California State Building Code, the California Unreinforced Masonry Program, the California Fire Alliance, and the California State Emergency Management System.

Lead Agency/Individual: City of Shasta Lake Manager.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

GOAL 2: INCREASE PUBLIC AWARENESS OF THE NATURAL HAZARDS

Public awareness and education are the most effective mitigation efforts to ensure reducing vulnerability to flooding and urban/wildland fire hazards. Public information activities advise property owners, potential property owners, and visitors about the potential local hazards and presents methods to protect people and property. It is important to increase public awareness and education through ensuring that hazard-related information is accessible by using outlets such as the Internet, initiating outreach and educational programs, providing real estate disclosure, making updated hazard-related materials available at the library, providing technical assistance, and publishing hazard emergency preparedness information and evacuation routes.

The Shasta County Sheriff's office initiated the public outreach process by posting the Homeland Security Advisory System recommendations for businesses (www.sheriff.co.shasta.ca.us/disasters.html) and excerpts from the U.S. Department of Justice's Citizen's Preparedness Guide for local residents (www.im-news.com/SOEmergency.html) on to website.

Action 2-A: Refer to the LHMP and Include Pertinent Elements of the LHMP into the City's General Plan and the Fire District's Fire Protection Plan

To ensure that the LHMP elements become an integral part of the City and Fire District's planning process, it is necessary to include pertinent elements of the LHMP into the City's General Plan and the Fire District's fire protection plan. Also, as the LHMP is updated through the evaluation process discussed in Section 5.0, this update should be reflected in the General Plan and fire protection plan.

Lead Agency/Individual: City of Shasta Lake Manager and Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

Action 2-B: Make Current Hazard Map Information Available Through the City and County Websites and Maintain a Hazard Database

To facilitate the urban/wildland fire and flooding hazard public education and awareness process, the City could post regional hazard-related information on its website, including maps and evacuation routes. The

website could also include contact information for NFIP inquiries (which would be directed to the City's Floodplain Administrator) and fire-related questions, which could be directed to the Fire District. By executing these activities, the City would qualify for credit under the CRS Activity 320-Map Information, which awards credit for providing responses to inquiries about the FEMA FIRMs.

The AutoCAD database at the Fire District could expand to include the GIS data developed for the LHMP, which identifies the hazards in the area and provides the locations of critical facilities. Data could be coordinated with the County and City of Redding to ensure that data and the maps remain updated.

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and the Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

Action 2-C: Increase Public Awareness of Potential Hazards of the Area and Provide Information on Safety and Health Precautions

As part of the public awareness process to reduce the City and Fire District's susceptibility to urban/wildland fire and flooding hazards, the City could designate a staff member to coordinate the following types of outreach projects, which would also qualify the City to receive credit under the CRS program:

- Send an article through a newsletter, utility bill, or other widely distributed document that addresses community natural hazard information to all properties in a hazard-specific area.

- Provide a "Hazard Safety" section in the telephone book yellow pages that outlines what a family can do in the event of a flood or fire. Checklists and recommendations listed on the FEMA website could also be included.

- Send an annual notice directed to properties in hazard-prone areas. The brochure or notice would discuss the local hazard, and present safety measures, property protection measures, and insurance information.

- Insert flyers in local newspapers announcing recent hazard news.

- Provide hazard information brochures at County, city, and public utility offices.

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

Action 2-D: Ensure Real Estate Disclosure

Currently, the City Floodplain Administrator handles inquiries from real estate agents regarding floodplains and the FEMA FIRMs. Increased public knowledge and awareness of the potential for flooding within the region can assist the community in reducing the risk to life and property due to flooding. The City could coordinate with local real estate offices to offer training classes to local realtors on FEMA FIRMs and the NFIP process and requirements and conduct mailings to the members of the Board of Realtors to publicize the map information services provided by the City.

Lead Agency/Individual: City of Shasta Lake Manager.
Cost Estimate/Potential Resources: General funds.
Schedule: Long-term.

Action 2-E: Keep the City Library Current With Up-to-Date Hazard Data Information

As part of the public education and awareness process and to assist in reducing the vulnerability to urban/wildland fire and flooding, the City library should be provided with the latest list of hazard protection references, government publications, Internet websites, and instructions on how to order free hazard documents. This activity also qualifies for credit under the CRS program, which requires that publications must be kept and distributed by the public library. The City Floodplain Administrator could be designated to coordinate with the library to maintain updated flood hazard and flood insurance information. A liaison designated by the City and Fire District could ensure that library records are current with publications related to hazards and hazard mitigation.

Lead Agency/Individual: City of Shasta Lake Manager, the City of Shasta Lake Floodplain Administrator, and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

Action 2-F: Organize and Participate in Educational Programs that Address Natural Hazards in the Area

Public education is one of the primary mechanisms in reducing future hazard-related losses, and one that is inexpensive in comparison to other mitigation projects. The City could initiate education activities that address urban/wildland fire and flooding hazards with schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts and summer camps.

Lead Agency/Individual: City of Shasta Lake Manager and the Shasta Lake Fire Protection District Chief.

Cost Estimate/Potential Resources: General funds.

Schedule: Short-term.

Action 2-G: Improve Coordination Between Agencies, Environmental Groups, and Developers and Coordinate With Neighboring Communities to Minimize and Mitigate Hazards

To ensure the effectiveness and continuation of urban/wildland fire and flood hazard mitigation efforts to reduce the region's vulnerability to these hazards, the City and Fire District should designate a staff member to coordinate, when appropriate, with the County Sheriff, the County Department of Resource Management, the County Department of Public Works, and other appropriate County departments, during the implementation of the proposed mitigation actions. The City and Fire District could also coordinate their emergency response and warning systems with the County and the nearby City of Redding by continually keeping the County Sheriff's office and the City of Redding's Fire Department updated with changes to the region's emergency management system. Also, the Fire District could coordinate new and existing fire mitigation efforts with the County and the City of Redding to facilitate a countywide fire mitigation effort. Available hazard data in the City and Fire District could be exchanged and coordinated with the City of Redding and the County.

Lead Agency/Individual: City of Shasta Lake Planning Department Manager and Shasta Lake Fire Protection District Chief.
Cost Estimate/Potential Resources: General funds.
Schedule: Short-term.

Current Mitigation Programs, Efforts, and Organizations

Mitigation program, efforts, and organizations currently available as a resource to implement the proposed actions include:

California Department of Forestry and Fire Protection

The Shasta-Trinity CDF Unit includes the region within City and Fire District boundaries. The Unit develops an annual Shasta-Trinity Fire Management Plan, which includes an assessment of the wildland fire potential and identifies areas for fire mitigation strategies. The primary fire plan responsibilities in the Unit are assigned to the Prevention Bureau within the Special Operations Division. CDF, the U.S. Forest Service, and the National Park Service administer wildland fire protection areas in the Unit.

California State Department of Water Resources Floodplain Mapping Awareness Program

The California Floodplain Mapping Awareness Program is currently limited to available floodplain mapping data, but all areas expected to develop over the next 25 years are anticipated to have their floodplains mapped by 2012. Initial floodplain mapping will be for "Awareness Floodplains," which identifies flood hazard areas using approximate assessment procedures. These floodplains will be shown simply as flood-prone areas without specific depth and other flood hazard data. Currently there are no completed studies in Shasta County.

California State Dam Safety Program

The California Water Code entrusts the regulatory Dam Safety Program to the Department of Water Resources through the Division of Safety of Dams (DSOD). The principal goal of this program is to avoid dam failure and thus prevent loss of life and destruction of property. Dams under state jurisdiction are an essential element of the California infrastructure that provides constant water supply. DSOD

reviews plans and specifications for constructing new dams or for enlarging, altering, repairing, or removing existing dams, under application, and must have grant approval before the owner can proceed with construction.

California State Building Code

The California Code of Regulations, Title 24, also known as the California Building Standards Code, provides standards for new construction so that structures are protected against known or expected forces such as wind, seismic, fire, snow-load, and ice.

California Unreinforced Masonry Program

Unreinforced masonry buildings are brick buildings constructed prior to 1933, predating modern earthquake-resistant design. Brick is not strengthened with embedded steel bars and is considered unreinforced. The buildings in the City and Fire District boundaries would not fall under this category, as development in the area did not begin until the 1940s and 1950s. The State Building Code identifies areas subject to seismic risk through zones (I-IV) of increasing risk, with Zone IV being the highest risk. Structures in Shasta County are protected for Zone III, which is considered moderate to high risk.

California Fire Alliance

The California Fire Alliance is a cooperative membership to support pre-fire activities, pre-fire management for public and community safety, minimizing costs and losses, and maintaining and improving the quality of the environment. The Alliance constitutes an interagency forum for coordinating member agencies' efforts.

Under Executive Order, the National Fire Plan was created as a cooperative, long-term effort of the U.S. Department of Agriculture's Forest Service, the Department of Interior, and the National Association of State Foresters to protect communities and restore ecological health on federal land. A major component of the National Fire Plan was funding for projects designed to reduce fire risks to people and property. A fundamental step in realizing this goal was identifying areas that are at high risk of damage from wildfire. Federal fire managers authorized state foresters to determine which communities were under significant risk form wildland fire on federal land.

CDF generated a list of California's "Communities-at-Risk." With California's extensive urban/wildland interface situation, the list of communities extends beyond just those on federal land. Three main factors were used to determine wildland fire threat to urban/wildland interface areas in California:

- Ranking Fuel Hazards
- Assessing the Probability of Fire
- Defining Areas of Suitable Housing Density that Would Create Urban/Wildland Interface Fire Protection Strategy Situations

The fire-threatened communities in California include a total of 1,283 communities. Although the City of Shasta Lake is not one of the communities, Redding is.

California State Emergency Management System (SEMS)

The California Standardized Emergency Management System (SEMS) is the system required by Government Code §8607(a) for managing responses to multi-agency and multi-jurisdiction emergencies in California. SEMS has been established to provide an effective response to multi-agency and multi-jurisdiction emergencies in California. By standardizing key elements of the emergency management system, SEMS is intended to facilitate the flow of information within and between levels of the system and facilitate coordination among all responding agencies (State Emergency Management Systems Guidelines, December 1994). Currently the City is institutionalized under the SEMS program.

Prioritization Criteria

The proposed mitigation actions should be prioritized to provide better focus in the process of mitigation planning and implementation. The prioritization process adopted here stems from an evaluation of the following categories:

- Social
- Economic
- Environmental

- Political
- Technical
- Administrative
- Legal

Questions to address in prioritizing the recommended mitigation actions include:

- Is the mitigation action technically feasible?
- What are the political implications?
- Who has the legal authority to design, implement, and manage the mitigation actions?
- Is the action beneficial to the community's economy?
- What are the long-term costs associated with the actions and how do they compare to the benefits?
- Does it comply with environmental regulations and fulfill the environmental goals of the community?

To better assist the prioritization process, Table 4-4 provides a point system; the higher the points, the greater the priority. The given priorities are subject to change based upon modified goals and actions throughout the on-going process of the LHMP review and update.

Table 4-4 Mitigation Prioritization

Mitigation Actions	Cost			Social Impact			Technical Feasibility			Legal Constraints			Environmental Impacts			Politically Controversial			Administrative Requirements			Total Points
	High	Moderate	Low	Negative	Moderate	Positive	Low	Moderate	High	High	Moderate	Low	Negative	Moderate	Positive	High	Moderate	Low	High	Moderate	Low	
	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	1	3	6	
Utilize the Fire Risk Assessment and Management Strategies (RAMS) Program		3				6		3			3			3			3			3		**21**
Establish Fuel Breaks	1					6			6	6				3			**3**		1			**21**
Establish and Maintain a Fire Fuel Management Plan	1					6		3			3			3			3		1			**20**
Establish a Fire Safe Council		3				6			6			1			6			**6**		3		**39**
Incorporate Fire Hazard Potential in the City General Plan			6			6			6			6		3			3			3		**33**
Develop and Adopt a Maintenance Plan for Streams and Channels	1					6		3			3			3			3		1			**20**
Increase Culvert and Bridge Capacity at Hilltop Circle Crossing on Churn Creek and the Interstate 5 Crossing on Moody Creek	1					6		3			3			3			3		1			**20**
Provide Early Warning of Life-Threatening Hazards		3				6		3				6		3				6		3		**30**
Develop an Emergency Response Plan for the Region, Including Evacuation and Rescue Routes	1					6		3				6		3				6	1			**26**
Submit Mitigation Project Applications Annually, at a Minimum		3				6		3				6		3				6	1			**25**
Refer to the LHMP and Include Pertinent Elements of the LHMP into the City's General Plan and the Fire District's Fire Protection Plan			6			6			6			6		3			3			3		**33**
Make Current Hazard Map Information Available Through the City and County Websites and Maintain Hazard Database		3				6		3				6			6			6		3		**33**
Increase Public Awareness of Potential Hazards of the Area and Provide Information on Safety and Health Precautions			6			6		3				6		3				6	1			**31**
Ensure Real Estate Disclosure			6			6			6		3			3				6		3		**33**
Keep the City Library Current with Up-to-Date Hazard Data Information		3				6			6			6		3				6		3		**33**
Organize and Participate in Educational Programs that Address Natural Hazards in the Area		3				6			6			6		3				6		3		**33**
Improve Coordination Between Agencies, Environmental Groups, and Developers and Coordinate with Neighboring Communities to Minimize/Mitigate Hazards		3				6		3				6			6		3			3		**30**

SECTION 5.0 PLAN MAINTENANCE PROCEDURES

Implementing, Monitoring, Evaluating, and Updating the Plan

The City and Fire District understand the importance of the LHMP as a valuable planning document that will enable the community to better understand and mitigate the natural hazards within their areas. The City and Fire District are committed to the continual use and maintenance of the LHMP and to formulating a Plan Implementation, Monitoring, Evaluation, and Update Committee (IMEUC). An IMEUC would monitor the implementation and maintenance of the mitigation actions, keep the LHMP updated, and assist in improving coordination efforts among various groups and agencies to address hazard mitigation in the region. Members could consist of local agencies and other concerned parties such as the County OES, and the City Planning, Development Services, and Public Works Department.

The IMEUC would follow up on the various hazard mitigation goals and actions, expand on the implementation actions, and report on the status of their projects. This would include describing which processes worked well, any difficulties encountered, how coordination efforts were progressing, and which strategies to revise. The IMEUC would meet at least annually to monitor progress toward implementing the mitigation actions. The IMEUC would evaluate each goal and action to determine its relevance to changing situations in the City and Fire District, as well as in federal and state policy, and to ensure they are addressing current and expected conditions. The committee would also evaluate the risk assessment portion of the LHMP to determine if this information should be updated with new parcel data information. The IMEUC should communicate with the City Planning Department and the Fire District to keep them informed of any elements that should be reflected in the City's General Plan and the Fire District's fire protection plan.

The LHMP recommends a minimum five-year report with minimum annual IMEUC meetings. However, in the case that a hazard event occurs before the annual review or 5th anniversary, this LHMP recommends that evaluating, updating, and revising the LHMP soon after the disaster. After the annual IMEUC review, the City and Fire District would have three months to update and make changes to the

LHMP before submitting it back to the IMEUC committee. On the 5th anniversary of adopting this LHMP, the IMEUC would prepare a five-year progress report that includes:

- Updates to the original plan.
- Inclusion of any hazard events that occurred during the past five years.
- A summary of important mitigation activities accomplished by participating agencies or communities.
- Evaluation of proposed mitigation actions, including how much was accomplished during the previous five years.
- Explanation of the reasons why any mitigation actions were not implemented or are behind schedule.
- New and/or revised mitigation actions.

The five-year progress report would be forwarded to the City Council, Fire District Board, the County, and state agencies. All status reports would be tracked and become a part of documenting, evaluating, and updating the LHMP.

Implementation Through Existing Programs

The City currently uses land use planning and building codes to guide and control development. After the City officially adopts the LHMP, these existing mechanisms should incorporate the hazard mitigation goals and actions. The City Planning Department could conduct periodic reviews of the City's land use policies and analyze any LHMP amendments. Fire mitigation actions provided in the LHMP should be incorporated into the Fire District's Fire Management Plan and updated with the LHMP. Coordination between the City, Fire District, and other entities in the area is necessary to identify additional programs and efforts to implement the LHMP mitigation goals and actions.

Continued Public Involvement

The IMEUC is responsible for the annual review and update of the LHMP. Although the IMEUC represents the public to some extent, the general public should be able to directly comment and provide feedback during the LHMP implementation, monitor, evaluation, and update process. Copies of the plan

and any proposed changes could be posted on the City's website, as well as a point of contact from the City and a link could be provided on the County website. A public meeting, publicized and hosted by the City, should also be held after each annual IMEUC meeting. This meeting would provide the public with a forum to express concerns, opinions, or ideas about the LHMP.

SECTION 6.0 ADDITIONAL FEDERAL AND STATE REQUIREMENTS

Environmental compliance and historic preservation are essential components of the mitigation project planning, approval, and implementation process. The following is a listing of some federal laws, state laws, and executive orders that may apply to the proposed or future mitigation actions in this LHMP.

- California Environmental Quality Act (CEQA)
- Clean Water Act (Section 401)
- Clean Water Act (Section 404)
- Endangered Species Act
- Executive Order 1190 Wetland Protection
- Executive Order 11988 Floodplain Management
- Executive Order 12898 Environmental Justice
- National Environmental Policy Act (NEPA)
- National Historic Preservation Act
- Wild and Scenic Rivers Act

Additional information on federal and state laws or requirements can be found on the websites listed in Table 6-1.

Table 6-1
Federal and State Requirements Resources

Institution, Organization, or Agency	Website
Federal Emergency Management Agency	www.fema.gov
Environmental Protection Agency	www.epa.gov
U.S. Fire Administration	www.usfa.fema.gov
National Fire Protection Association	www.nfpa.org
U.S. Army Corps of Engineers	www.usace.army.mil
U.S. Geological Survey	www.usgs.gov
U.S. Department of Agriculture Natural Resources Conservation Service	www.nrcs.usda.gov
ESRI/FEMA Hazards Awareness Site	www.esri.com/hazards
California Department of Fish and Game	www.dfg.ca.gov
California Law	www.leginfo.ca.gov

Table 6-1
Federal and State Requirements Resources

Institution, Organization, or Agency	Website
California Governor's Office of Planning and Research	www.opr.ca.gov
California Governor's Office of Emergency Services	www.oes.ca.gov
California Department of Water Resources	www.dwr.ca.gov
California Department of Forestry-Fire and Resource Assessment Program	http://frap.cdf.ca.gov

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Appendix A – Maps

Hazard	Map Number	Title	Information Included
None	1	Base Map	Area base map
None	2	National Elevation Dataset (NED) Shaded Relief Imagery	Topographic map of the area
Fire	3	Historical Fire Locations	Historical fire locations
Fire	4	Wildland Fire Threat	Areas considered within 2,400 meters of varying levels of threat
Flooding	5	FEMA Flood Insurance Rate Maps (FIRMs)	FEMA floodplain designations
Flooding	6	Areas of Repetitive Inundation	Repetitive inundation as indicated by City staff, with the FEMA floodplain designations
Drought	7	Drought Conditions	Drought conditions as determined by NOAA
Drought/Fire	8	Average 2003 Temperatures	Average temperatures for 2003
Drought/Fire	9	Maximum 2003 Temperatures	Maximum temperatures for 2003
Drought/Fire /Flooding	10	Precipitation Levels for 2003	Precipitation levels for 2003
Flooding	11	Reservoir/Dam Inundation	Areas subject to inundation after a reservoir or dam failure
Earthquake	12	Earthquake Vulnerable Areas	Earthquake probabilistic shaking-spectral acceleration (probably ground shaking)
None	13	Population Density	Population per square mile
None	14	Residential Density	Housing units per square mile
None	15	Critical Facilities	Critical facilities in the City and Fire District
Fire	16	Proximity of Critical Facilities to Areas of Wildland Fire Threat	Wildland fire threat within 2,400 meters and critical facilities, which include hazardous materials, schools, shelters, train stations, hospitals, police or fire departments
Flooding	17	Property Loss Due to Flooding	One-time property loss due to flooding and FEMA floodplain designations
Flooding	18	Proximity of Critical Facilities to the FEMA-Designated Floodplain	FEMA floodplain designations and critical facilities, which include hazardous materials, schools, shelters, train stations, hospitals, police or fire departments
None	19	Shelters	Locations of shelters within the City and Fire District

Appendix B DMA 2000

Appendix C Meetings

Appendix D – Fire Safe Council Start-Up

From the Fire Safe Council website at www.firesafecouncil.org:

Starting a Council: Membership Recruitment

Your first step is to recruit members. Identify the potential public and private partners in your community who are at risk of loss from wildfire. Here are some examples of potential members:

- The Fire Department can provide advice and expertise on fire safety.
- Utilities, such as the water district or the electric company, have a vested interest in fire safety because their services may be disrupted when a fire occurs. The electric company is especially concerned about trees growing into power lines and starting fires.
- Environmental groups are especially concerned about habitat loss for endangered species when fires occur, as well as a number of other fire-related issues.
- Insurance industry representatives are interested in insuring and continuing to insure communities that have taken fire safety measures.
- Landscapers can provide information on fire safe landscaping and help educate homeowners about choosing more fire-resistant plants.
- Real estate agents are the first people homeowners meet when they are moving into the neighborhood. Real estate agents may educate homeowners about potential fire danger and provide information on how homeowners can protect themselves.
- The Parks and Recreation Department seeks to protect natural areas from damaging wildfire and may educate the community about fire's role in the ecosystem.
- Local political leaders can mobilize the community to become fire safe and represent community fire-safe concerns/initiatives in government.
- Homeowner associations have a vested interest in protecting their individual homes, as well as their neighborhoods, from wildfires.
- Other local groups that have a vested interest in fire safety; this could and should be just about anyone who lives or works in the area.

Starting a Council: Send an Invitation

Write a letter to each potential partner explaining the Fire Safe Council's goals and inviting them to a Fire Safe Council meeting. Here is a prototype invitation letter.

Sample Invitation Letter:

NAME
NAME OF ORGANIZATION
ADDRESS
CITY, STATE, ZIP

Dear [NAME],

We are all concerned about the potentially devastating effects of wildfire on our families, homes, businesses, and neighborhoods. As we enjoy living and working in the scenic surroundings of [NAME OF COMMUNITY], we must realize that our beautiful community could be destroyed in a wildfire. To help protect ourselves from this threat and minimize our potential losses, we invite you to attend a formation meeting of the [YOUR CITY/COUNTY] Fire Safe Council.

The purpose of the meeting is to bring together public and private organizations to discuss fire safety in our community. This community-based fire safety concept was born out of the statewide Fire Safe Council whose goal is to preserve California's natural and man-made resources by mobilizing all Californians to make their homes, neighborhoods, and communities fire safe. There are approximately 60 local councils throughout the state.

Our Fire Safe Council could be used as a forum to share information, solve problems, and link related programs to save money and time. The public safety issues we discuss may even extend beyond fire safety, to earthquake preparedness, emergency medical response, etc.

The success of the council depends upon the willingness and participation of PEOPLE/ORGANIZATIONS like YOU/YOURS. Your participation is essential to protecting what you value most. Your views would be shared with local decision-makers, as well as private companies.

The Fire Safe Council meeting is scheduled for [DATE and TIME] at [LOCATION] in [CITY]. Enclosed is a brochure on the council for your review, as a well as an overview of some of the statewide council's accomplishments. In addition, if you would like to explore the Council concept further, please visit the Fire Safe Council's website at www.firesafecouncil.org.

I hope you can join us in this valuable community service. I will contact you in a few days to determine your attendance. In the meantime, if you have any questions, please do not hesitate to call me at [YOUR PHONE NUMBER]. We look forward to seeing you at the meeting.

Best regards,

YOUR NAME
YOUR ORGANIZATION

Starting a Council: Preparing for the First Meeting

Contact Local Fire Safe Groups

Contacting members of other Fire Safe Councils is a good way to learn about successful grassroots fire-safe programs. Access some local Council's at www.firesafecouncil.org.

Contact the Fire Safe Council Speakers Bureau

The Fire Safe Council Speakers Bureau can make arrangements for a Fire Safe Council representative to speak to your community about the benefits of forming a Fire Safe Council. For more information, see the section of the handbook entitled, "Fire Safe Council Speakers Bureau."

Select a Meeting Location

Hold the first meeting in a neutral location such as the local community center or library. Try to select a meeting place where everyone will feel comfortable sharing their ideas and concerns.

Create an Agenda

Fire safety can be a complicated issue. At your first Fire Safe Council meeting, keep your agenda simple and uncomplicated. Agenda items should be broad, topical areas that can be used as starting points for productive discussions. The goal of the first meeting is to begin a dialogue and build consensus. Avoid discussing controversial, divisive topics at the first meeting.

Appoint a Facilitator

Choose one person to direct the first meeting. A good facilitator has the ability to work with people and achieve consensus. The facilitator should be neutral, and understand the diverse views of members and be able to put them in the context of the larger issue. He or she should not be easily swayed by opinion and should have the ability to evaluate issues and concerns raised by members.

Sample Agenda For First Meeting:

FIRE SAFE COUNCIL
MEETING AGENDA
DATE
I. Welcome

II. Introductions
III. California's Fire Problem/The California Fire Plan
    A. Map of (NAME OF COMMUNITY/COUNTY'S) fire danger
IV. The Fire Safe Council Concept
V. Goals and Objectives
VI. High Fire Hazard Areas
VII. Fire Safe Projects
VIII. Appointment of Executive Officers
IX. Open Forum
X. Next Meeting
    A. Location
    B. Action Items

Starting a Council: At The Meeting

Take Meeting Minutes

Meeting minutes are valuable because the group can refer back to the minutes to recall the events of past meetings. This is an excellent way to keep track of new ideas and responsibilities for projects. A sample of the meeting minutes is provided later in this handbook. Whoever takes meeting minutes should be willing to type them up after the meeting. It may also be a good idea to mail or e-mail minutes to Council members to keep them updated.

Develop a Membership Roster

Circulate an attendance sheet during the meeting and have Council members write down their names, addresses, telephone numbers and, if available, their e-mail addresses. The person taking meeting minutes should type up a Fire Safe Council roster so that members can get in touch with each other between meetings.

Display a Map of the Community

The map is to help the Council identify areas of concern and high fire hazard areas in the community. It could assist the Council prioritize potential fire safe projects. Your fire department may be able to help create a map showing specific fire danger areas.

Share Fire Safety Brochures and Materials

Your local fire department may have information to share. Visit the Fire Safe Council's web site for brochures on fire safe landscaping, fire safety for inside and outside the home, a fire safe homeowners checklist and more. The Fire Safe Council is at www.firesafecouncil.org, or call the statewide Council at 916/447-7415 to request materials.

Starting a Council: Make the Most of the Meeting

Welcome

Greet the newly formed Council by welcoming members to the first meeting. Most of them probably have very busy schedules. They may be attending this initial meeting to determine if their membership is a good use of their time. Express gratitude for their attendance and convey a vision that this Fire Safe Council can make a difference in the community.

Introductions

Ask everyone in the room to introduce themselves and their organizational affiliation. Revealing the group's diversity allows everyone to see how wildfire affects the entire community.

California's Fire Problem

Explain California's fire problem. A fire safety expert, such as the fire chief, could help the group understand the role of fire in the ecosystem and how it affects your community. Ask the fire official to also discuss the California Fire Plan.

The Fire Safe Council Concept

To explain the Fire Safe Council concept, consider showing the Fire Safe California Community Action video. This video explains the nature of fire and how forming a Fire Safe Council helps minimize the losses caused by devastating wildfires. The video also briefly explains the main steps to forming a Fire Safe Council. Alternatively, you may contact the Fire Safe Council Speakers Bureau, 916/447-7415 and request a Fire Safe Council representative to attend the initial meeting and present the Fire Safe Council concept to the group.

Goals and Objectives

The facilitator should ask Council members to list major goals and objectives. Turn the meeting into a brainstorming session by asking each participant to answer the question: "What do I want this group to accomplish?" This would help identify fire safety problems or objectives important to the group. Try posting the ideas on a board and include them in the meeting minutes.

High Fire Hazard Areas

A map would help the Council identify geographic areas of concern and high fire hazard areas in the community. The Council should refer to the map to help prioritize potential fire safe projects. The Council should not only consider existing neighborhoods, but also look at business districts and areas of planned residential and commercial development that are near forest or wildland. The Council should also identify the community's assets at risk -- all the people, places, natural resources and other assets that need protection from wildfire.

Fire Safe Projects

Identify projects the Council can accomplish and assign oversight responsibility to members. The person or group will provide progress reports to the Council at future meetings or ask for further assistance, if necessary. The project should be put into a time frame with a target date of completion.

Ideas

- Chipper Days: The Mission Viejo Fire Safe Council identified a specific neighborhood needing brush fire clearance. It arranged to collect green waste, which was chipped and recycled after homeowners cleared the brush. One of the Council members donated a chipper to do the work.
- Fire Safe Demonstration Garden: FireSafe San Diego built a fire safe demonstration garden at a community fair and won awards for the display. The Mission Viejo Fire Safe Council created a permanent garden next to the city's library.
- Community Arson Watch Program: Similar to the neighborhood watch program that monitors crime, the arson watch program monitors suspicious behavior on high fire risk days, as defined by your local fire department. FireSafe San Diego volunteers patrol the area for arsonists on severe fire weather days.

Appointment of Executive Officers

Typically, executive officers include a chairperson, vice chairperson, treasurer and secretary. However, many councils have designated only a chair and co-chair. Your council should determine the leadership it feels most comfortable with.

Open Forum

Give Council members the opportunity to make announcements or raise issues that were not addressed in another area of the agenda.

Next Meeting

Set a date. Do not postpone setting a date and contacting all the participants later. Since everyone is at one location at the current meeting, this is the best time to announce a date. You may want to secure the location and some potential dates for the next meeting beforehand to make scheduling easier. Over time, consider setting a meeting schedule for the year or assigning a constant, specific meeting date. (e.g. the third Tuesday of each month).

Starting a Council: The Second Meeting

Develop a Mission Statement

A mission statement is a statement of purpose and the ideal or basic reason for the existence of the organization. It should be broad in scope and define the organization's philosophy. In addition, it should be short and easy to understand. Based on your discussion of what everyone wanted to accomplish with the Fire Safe Council, create a draft mission statement and present it at the second meeting. Once you or another Council member has proposed a mission statement, the Council should review and finalize it.
Consider reviewing mission statements from other Fire Safe Councils. Here is the mission statement for the statewide Fire Safe Council:

"The mission of the Fire Safe Council is to preserve California's natural and manmade resources by mobilizing all Californians to make their homes, neighborhoods and communities fire safe."

Determine Overall Objectives

After establishing a mission statement, Council members should think about fulfilling the mission. Objectives should state what will occur if the mission is successfully achieved. When determining objectives, make sure they relate to the mission and that they are measurable, achievable, and results-oriented. Consider reviewing the objectives from other Fire Safe Councils. Here are the objectives for the statewide Fire Safe Council:

- Unite Council members to speak with one voice on fire safety
- Use marketing expertise and communication channels of Council members to increase distribution of fire prevention education materials
- Discuss and evaluate legislation pertaining to fire safety
- Empower grass roots organizations and individuals to create fire safe communities

Finalize a Name and/or Logo

Choose a name for your Council to give it an identity. Most local Fire Safe Councils have chosen to include a specific city or region in their name. Nevada County Fire Safe Council, FireSafe Marin, or the Laguna Beach Insurance Free Choice Discussion are examples.

Pick a logo for the group to establish an identity in the community. Use the logo on letterhead, meeting agendas, fire safe project signs, brochures or anything you want to associate with the Council. Many Fire Safe Councils have adopted the statewide Fire Safe Council's logo, while others have either altered this logo to fit their Council's needs or created an entirely new logo. Download the statewide Council's logo from www.firesafecouncil.org.

Revisit Projects and Determine Feasibility

Persuade Council members to examine their resources and determine how each member could contribute to a project's success. Many new councils choose to begin with small projects and work their way up to larger undertakings. Small projects will yield faster results and gratification, which will build momentum for the group.

Assign Responsibility for Projects

Ask for volunteers and be encouraging, as some members may be shy or hesitant because this is a new area of knowledge for them. Some Council members may have a special interest in specific projects, or may be able to commit certain resources. Make sure that all projects undertaken by the Council have been assigned to an individual or group of individuals to ensure that the project gets done.

Target Future Members

Fire safety involves the whole community and the health of your Council depends upon constant efforts to involve more people. Enlist volunteers to focus on membership recruitment. Remember, it may take several months to convince certain partners to participate in your Council. In fact, some partners may not join the Council until a fire threatens. This fire could create a window of opportunity for your Council to attract new members and advance fire safe programs.

Starting a Council: The Third Meeting

Approve the Mission Statement and Goals

If you have not done so, reach consensus and approve the mission statement.

Ask Members to Provide Status Reports

This would promote a feeling of progress and, eventually, a sense of accomplishment. Praise success and troubleshoot roadblocks. These status reports will generate excitement for projects and help sustain the Council's momentum.

Look to the Future

Although the Council may have temporarily exhausted its short-term resources, it is important to continue to look at the future of the Council. Brainstorm a few ideas for possible future fire safety projects and distribute these ideas to the Council. This will encourage Council members to begin thinking about tackling the next project or inspire them to initiate new ideas.

Ideas

- Community Awareness Project: Partner with a local sports team to host an event to promote awareness of fire danger, including a display at the stadium/ballpark, informational handouts and

children's competitions.

- Alternative Water Source Identification: Community-wide program to identify and provide a standard pavement or curb marker for homes with pools and spas which could serve as additional and alternative sources of water for firefighters during an extensive fire.
- Toll free 1-800 Fire Safe Phone Line: Hosted by a local phone company.
- Fire Safe Outreach Teams: Volunteers trained and organized in advance to answer questions, provide speakers and give presentations when seasonal change and heightened public awareness or anxiety create "teachable moments."

Non-Profit Status

Some local Fire Safe Councils have obtained non-profit status to easily accept donations. The Council should weigh all options and fully investigate the requirements for non-profit status before making a decision. To find out about the benefits of non-profit status and some of the alternatives, refer to the section, "Does Your Council Need Non-Profit Status?"

Starting a Council: Sustaining Momentum

It is vital to maintain enthusiasm and interest in the Council among members. Here are a few ideas to get you started:

Recruit New Members

New members will bring new ideas to the Council. Review the original invitation list you sent to the community. Identify invitees who do not attend Council meetings and persuade them to come to the next meeting. Is there anyone missing from the list?

Ask Each Member to Bring an idea for a Fire Safe Project

Different members have different areas of expertise. Tap the diversity of Council members by encouraging members to think of creative projects that interest them and their organizations. Members devote more time and energy to a project when they see a direct benefit.

Continue to Communicate With Existing Fire Safe Councils

More established Councils have already experienced many of the growing pains your Council may experience and can provide insight on what works and what does not. Invite members of another Council to attend your Council meeting and speak.

Get Help from the Statewide Council

The statewide Fire Safe Council is a source for videos, brochures, public service announcements, and helpful hints. Use the Council's materials in your community. Canvass the neighborhood providing fire safety brochures to homeowners. Or work with your local cable television provider to broadcast a fire safety video or public service announcement. For example, Mission Viejo localized the Fire Safe Inside and Out video by creating an introduction from its fire department. Why spend precious resources creating new materials when the information is available right now? Most items can be downloaded from www.firesafecouncil.org.

Participate in Community Events

Gain visibility by setting up a booth at a community fair and handing out fire safe information. Or, educate the community about fire safe landscaping by creating a small fire safe garden for fair-goers to enjoy.

Invite Members of the Fire Safe Council Speakers Bureau

Veteran Council members at the state and local levels have made themselves available to visit Councils all over California. Speakers can share their strategies for helping communities begin Fire Safe Councils, funding sources for Councils, and expanding Council membership.

Also, invite your own members to speak about their expertise, what they do, and how it affects the community's fire safety.

Generate Publicity

Once a fire safe project is underway, share your good news! Call the local daily or weekly newspaper, and radio and television stations. Tell the editors about the Council's fire safe project and how it will benefit the community. Or, write a news release about the project, send it to local media and follow up with a telephone call to determine if they will cover it.

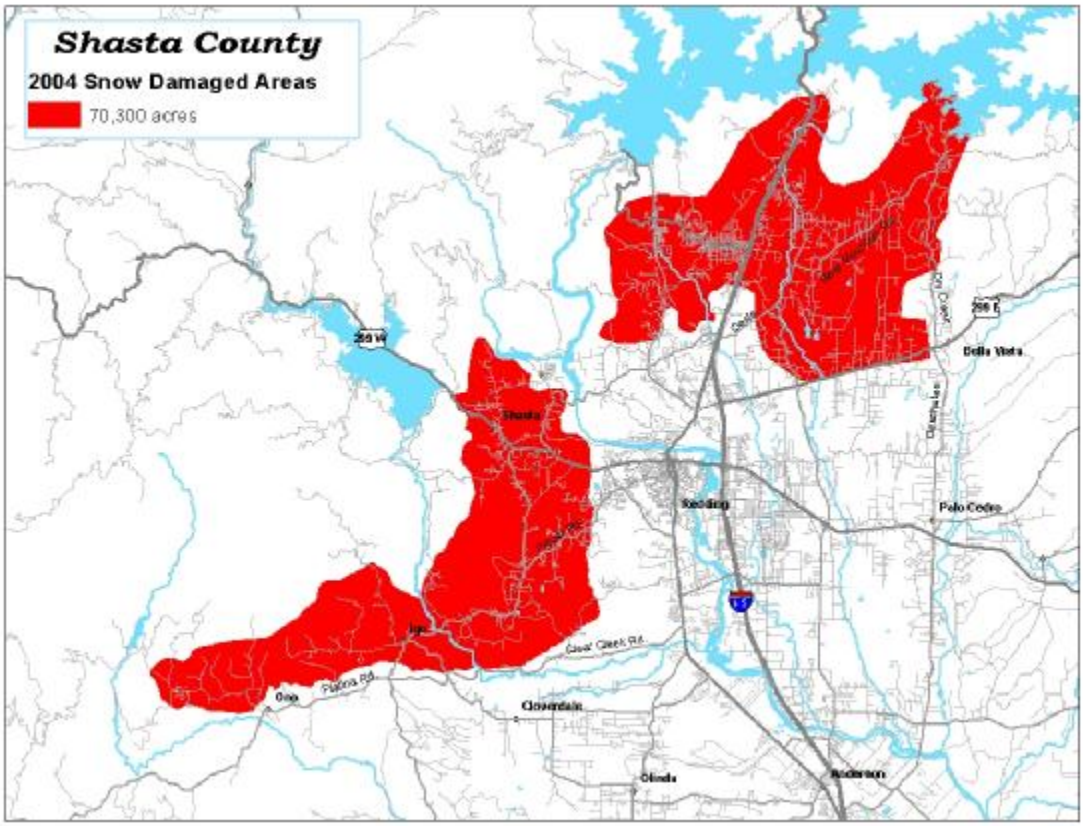
Appendix E – Fire Safety Briefing

CALIFORNIA DEPARTMENT OF FORESTRY

AND FIRE PROTECTION

SHASTA-TRINITY UNIT

FIRE SAFETY BRIEFING



In late December 2003, the Shasta-Trinity Unit experienced an unusually cold, wet, low elevation snowstorm. The snow accumulation and following high winds resulted in broken tree limbs and knocked down brush as shown on the accompanying map (approximately 70,000 acres). This fuel is now dead and either lying down in the grass or is hung up in the live fuels creating a laddering effect in the brush/Oak/ Western Grey Pine/Knob Cone fuel zone.

Fuels Assessment

There is ground level and landscape level mortality of 10-50% in the Live Oak and somewhat less in the Grey Pine belt, West and North of Redding (See Map) of approximately 70,000 acres. Standing, suspended, and down dead fuels, could range to 35 tons per acre in heavily impacted areas. The seasonal grass cure is in progress and should be complete by late May. At the

currently measured fuel moisture levels our brush fuel models should become critical by mid to late June. The 1000 hr. fuels in the North State are recording below the 30-year low and dropping.

Fire Behavior

The combination of heavy vegetation mortality (storm damaged), resulting in additional, cured "available" fuel loading, a dry spring, low 1000 hour fuel moistures, the long range fire weather outlook of higher than normal temperatures, below or normal rainfall through October, all indicate a high potential for severe or extreme fire behavior.

The direct impact on fire behavior within the affected area will be:

- Higher flame front intensities due to dramatically increased "dead fuel loading".
- Torching of these jackpots of available fuel. The dead leaves and needles will result in heavy ember production and increased spotting potential. This will be seen much earlier in the season than normal and intensify as the season progresses.

Trigger Points for Severe and Extreme Fire Behavior

- Relative Humidity <20%
- 20' Winds 7 MPH or greater
- 1000 Hr. FM <12%
- Live FM in Manzanita <78%

Remember: Trigger points are NOT decision makers, or absolutes, but serve as predetermined cues to prompt you to re-evaluate the situation and associated risks. Trigger points help you to determine and implement the proper course of action.

Safety

Review safety issues with your crew NOW.

- 10 Standard Fire Fighting Orders
- Eighteen Watch-Out Situations
- LCES
- Common Denominators of Fire Behavior on Tragedy Fires

The following items will pertain to the affected area:

- Look up, look down, and look around. There is more dead fuel overhead. Broken tree limbs/tops up to 12 inches in diameter have been observed. Fire burning lower supporting vegetation and airdrops may dislodge broken limbs or even healthy looking tree limbs.
- The conversion of live fuel to dead fuel will result in increased energy release component. Expect direct attack to be more difficult and indirect attack to be more dangerous. Spotting will be a concern.
- The added down fuel will make travel difficult and slow. It may also slow productivity rates of hose, hand and dozer lines. Order resources appropriately. Your tactics may need to be altered; for example, a saw team cutting ahead of a hose lay.
- Fuels in the draws and chimneys appeared to be more affected by this storm than wide-open, continuous slopes. Be alert when spotting your equipment and anchoring your line.

Appendix F – Hydraulic Analyses

WOOD RODGERS

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Fax: (916) 341-7767

PROJECT:	City of Shasta Lake and Shasta Lake Fire Protection District LHMP			JOB #:	**8248.001**
FEATURE:	**Hydraulic Analysis**	BY:	**JPP**	DATE:	**9/1/04**
ITEM:	**Identification and Evaluation of Flood Hazard Areas**	CHECKED:	**MKR**	DATE:	**9/15/04**

PURPOSE:

The purpose of this analysis is to identify and evaluate flood hazard areas in Shasta Lake, and to identify potential mitigation objectives.

DATA AVAILABLE:

FEMA FIS for Shasta Lake, performed by Borcalli & Associates in 1995, HEC-2 model filenames: "MOO.DAT," and "CNB1.DAT"

ANALYSIS and CONCLUSIONS:

The City of Shasta Lake has identified several culverts within the City limits that are subject to frequent flooding:

- One 48-inch and one 30-inch CMPs at the intersection of Oak Avenue and Beacon Street.
- Two-36-inch CMPs west of the intersection of La Mesa Avenue and Ashby Road.
- Street flooding along Mead Street between Montana Avenue and Hardenbrook Avenue.
- One 24-inch CMP at the intersection of Red Bluff Avenue and Washington Avenue.
- One 24-inch CMP on Mussel Shoals Avenue between Red Bluff Avenue and Koch Street.
- One 36-inch CMP at intersection of Parker Street and Grand Coulee Boulevard.

With the exception of the culvert at Parker Street and Grand Coulee Boulevard, none of the culverts identified as being subject to frequent flooding lie within the 100-year floodplain. Although the Parker/Grand Coulee crossing does lie within the 100-year floodplain, it is located in an area designated as shallow (X Zone) flooding that results from out-of-bank spilling from Moody Creek rather than local drainage. Flood incidents at these locations are likely the result of an undersized or unmaintained local drainage system. The local runoff tributary to these culverts as well as the hydraulics of the culverts cannot be evaluated without more detailed hydrologic and topographic information. However, in general, it is assumed that larger culvert sizes and the implementation of a channel maintenance program at the upstream and downstream faces of these crossings would provide the necessary capacity to alleviate high recurrence flooding.

In the FEMA FIS for Shasta Lake, there are two residential areas that are subject to inundation from split flows during a 100-year storm event. These include:

- Hilltop Circle Crossing on Churn Creek. Shallow flooding occurs during the 100-year storm as a result of an undersized culvert crossing.
- Interstate 5 Crossing on Moody Creek. The existing pair of 9.5-foot-diameter culverts do not have capacity to convey the 100-year storm. During the 100-year storm, water checks up behind the Highway and Shasta Dam Boulevard, eventually overtopping Shasta Dam Boulevard and spilling southward parallel to Shasta Street and Cascade Boulevard.

ATTACHMENTS:

Table F-1 – Comparison of Existing Conditions in Moody Creek With Proposed Crossing Improvements
Table F-2 - Cost Estimate for Interstate 5 Crossing Improvements
Location Map F-1 – Hilltop Circle Crossing on Churn Creek
Location Map F-2 – Interstate 5 Crossing on Moody Creek

RESULTS:

Hilltop Circle Crossing on Churn Creek - A major constraint at this location is that the channel slope is fairly shallow, which requires relatively large increases in conveyance capacity to influence the water

surface elevation in the channel. Wood Rodgers imported the FIS HEC-2 model for Churn Creek (filename: "CNB1.DAT") into HEC-RAS and determined over the course of several modeling iterations that to ensure that no spill occurs during the 100-year event, the existing crossing would need to be modified to accept five additional 4'x4' box openings and the channel upstream and downstream of the crossing would need to be widened an additional 25 feet. An additional alternative that could provide an equivalent level of flood protection for the overbank would be to construct a floodwall. With either of these improvements, the roadway is still overtopped and a great deal of overland conveyance is required near the bridge.

Interstate 5 crossing on Moody Creek - To mitigate this flooding condition, the capacity of the I-5 crossing could be increased. Wood Rodgers imported the FIS HEC-2 model for Moody Creek (filename: "MOO.DAT") into HEC-RAS and determined over the course of several modeling iterations that adding a single 102-inch-diameter RCP would be sufficient to convey the 100-year storm without spilling over Shasta Dam Boulevard. Increasing the conveyance capacity of the crossing results in generally higher downstream water surfaces (Table F-1). Near the Moody Creek Road crossing, the channel water surface elevation actually decreased as a result of the improvements at I-5. However, this is somewhat misleading in that this is a result of the flow transitioning to critical depth at this location (the energy grade line at this location is actually higher than existing conditions).

Implementing this improvement would likely involve a bore and jack operation so as not to disrupt the utility of the highway and would cost approximately $1.3 million (Table F-2).

In addition to this, Wood Rodgers evaluated constructing a floodwall as an alternative to increasing the crossing conveyance at this location. Shutting off the split flow without increasing the existing crossing capacity results in inundation of the highway as well as water surface increases of over two feet upstream of the crossing. As such, this alternative is likely unsuitable as a mitigation alternative.

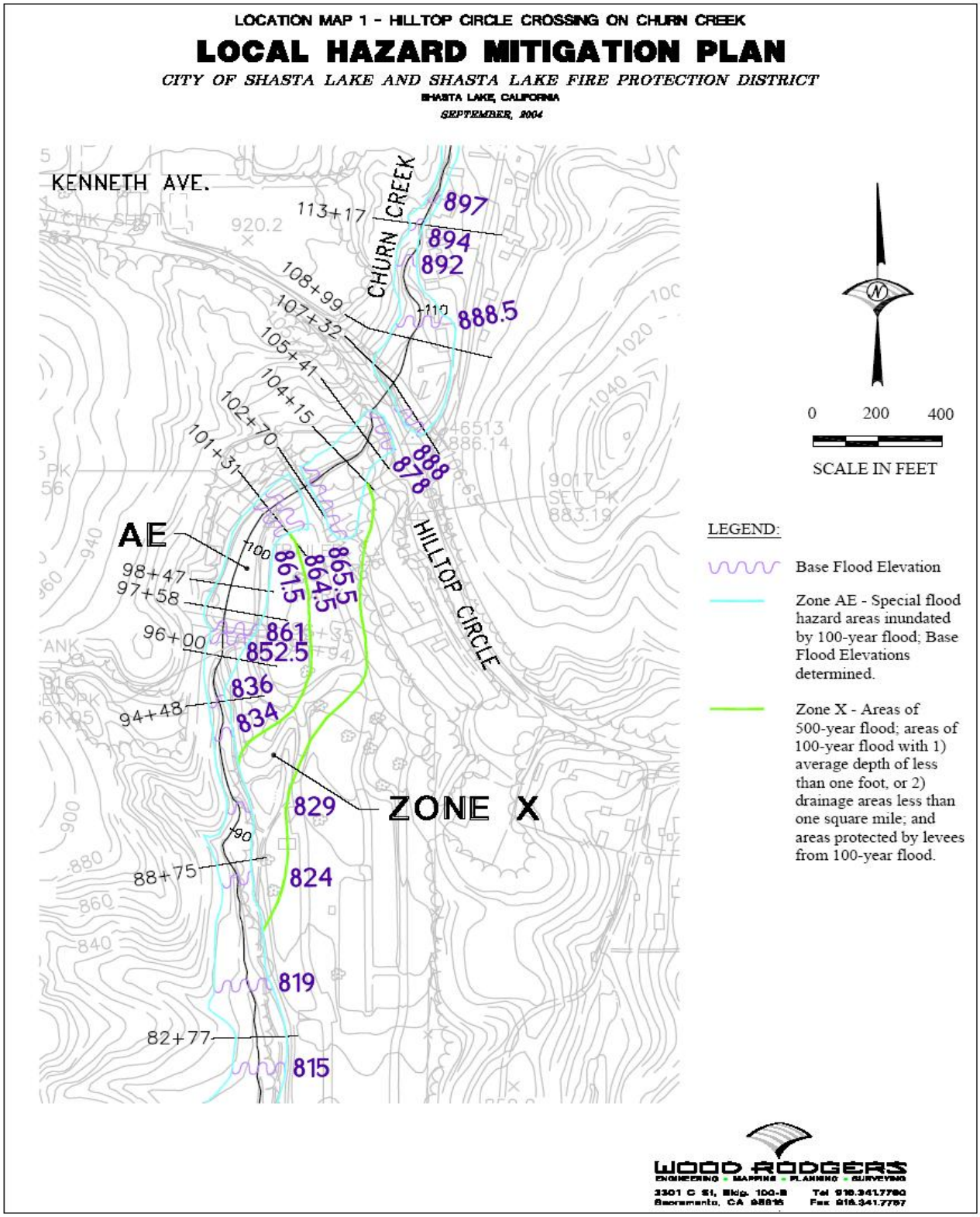

Figure F-1 Hilltop Circle Crossing on Churn Creek

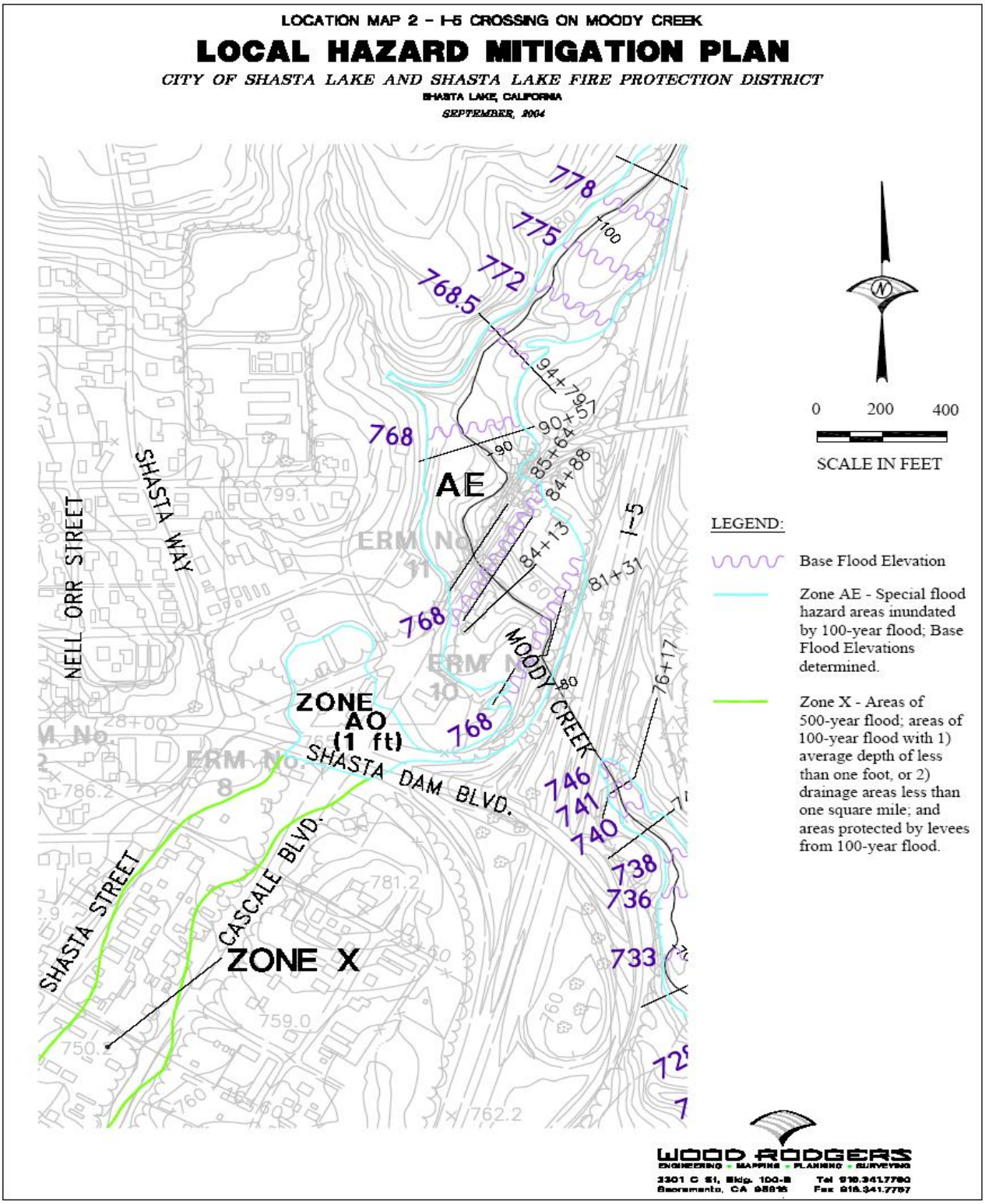

Figure F-2 Interstate 5 Crossing on Moody Creek

TABLE F-1
Impacts Of Proposed Crossing Improvements on Moody Creek At Interstate 5

	Existing		Proposed		
River Sta	**Q Total**	**W.S. Elev**	**Q Total**	**W.S. Elev**	D **W.S. Elev**
	(cfs)	**(ft)**	**(cfs)**	**(ft)**	**(ft)**
17716	740	867.79	740	867.77	-0.02
17106	740	856.3	740	856.34	0.04
16534	1400	851.83	1400	851.9	0.07
16031	1400	845.78	1400	845.77	-0.01
15800	1400	843.02	1400	843.07	0.05
15638	1400	840.89	1400	840.91	0.02
15196	1400	833.95	1400	833.99	0.04
14689	1400	824.9	1400	824.86	-0.04
14089	1400	818.71	1400	818.79	0.08
13602	1400	814.56	1400	814.59	0.03
13256	1400	812.56	1400	812.73	0.17
12883	3800	808.6	3800	808.47	-0.13
12293	3800	801.86	3800	802.14	0.28
11831	3800	796.83	3800	796.97	0.14
11222	3800	790.96	3800	790.96	0
10767	3800	786.8	3800	786.77	-0.03
10234	3800	780.89	3800	780.95	0.06
9479	3800	768.37	3800	768.44	0.07
9057	3800	767.97	3800	763.38	-4.59
8564	3800	767.94	3800	763.29	-4.65
8554	3800	767.93	3800	763.26	-4.67
8541	Bridge		Bridge		
8528	3800	767.94	3800	763.13	-4.81
8488	3800	767.94	3800	763.13	-4.81
8413	3800	767.94	3800	763.14	-4.8
8288	3800	767.89	3800	762.95	-4.94
8131	3304.64	767.88	3800	762.95	-4.93
8101	3304.64	767.33	3800	762.51	-4.82
7911.5	Culvert		Culvert		
7722	3304.64	744.99	3800	743.69	-1.3
7617	3304.64	741.16	3800	741.72	0.56
7440	3304.64	739.23	3800	739.62	0.39
6820	3504.64	731	4000	731.43	0.43
6291	3504.64	723.13	4000	723.69	0.56
5702	3504.64	712.66	4000	713.17	0.51
4982	3504.64	698.36	4000	698.99	0.63

TABLE F-1
Impacts Of Proposed Crossing Improvements on Moody Creek At Interstate 5

	Existing		Proposed		
River Sta	**Q Total**	**W.S. Elev**	**Q Total**	**W.S. Elev**	D **W.S. Elev**
	(cfs)	**(ft)**	**(cfs)**	**(ft)**	**(ft)**
4335	3504.64	690.73	4000	691.4	0.67
3803	3504.64	685.89	4000	686.43	0.54
3312	3604.64	678.46	4100	679.05	0.59
2608	3604.64	674.6	4100	675.17	0.57
1970	3604.64	671.55	4100	672.05	0.5
1451	3604.64	670.39	4100	670.67	0.28
768	3604.64	669.63	4100	669.67	0.04
758	3604.64	669.39	4100	669.29	-0.1
753	3604.64	669.29	4100	669.26	-0.03
746.5	Bridge		Bridge		
740	3604.64	667.36	4100	668.7	1.34
735	3604.64	666.86	4100	667.3	0.44
555	3704.64	664.05	4200	664.33	0.28
0	3704.64	659.13	4200	659.46	0.33

TABLE F-2
Moody Creek Crossing at Interstate 5 Improvement Alternative
Opinion of Probable Costs

Item	Qty.	Unit	Unit Cost, $[1]	Cost, $
Interstate 5 Crossing Improvements				
Site Preparation	0.1	ac	1150	66
Bulk Excavation	1,703	cy	1.9	3,236
Structural Excavation	16	cy	2.6	43
Structural Fill	16	cy	0.92	15
Structural Compaction	16	cy	1.78	29
Place and Haul in Trucks	1,703	cy	1.96	3,339
Spread, Compact, and Shape Excess Material	1,703	cy	2.75	4,684
Demolish Existing Wingwalls	187	cf	22.11	4,127
Reinforced Concrete - Headwalls and Wingwalls	29	cy	750	21,667
Bore & Jack 102-inch Pipe Under I-5	378	lf	1400	529,200
102-inch RCP	378	lf	700	264,600
Cofferdam installation and removal	1	ls	8000	8,000
8-inch Discharge Pipe from Cofferdam	30	lf	0.39	12
Construction Dewatering	1	ls	25000	25000
Subtotal				**864,018**
Mobilization (5%)				43,201
Construction Contingency @ 25%				216,004
Subtotal				**1,123,223**
Engineering, Surveying, and Contract Administration @ 20%				172,804
Interstate 5 Crossing Improvement Subtotal				1,296,027
Total (Construction Costs Only)				1,296,027
Land Acquisition				
Interstate 5 Crossing Improvement Site	0.1	ac	40,000	2,296
Subtotal				**2,296**
TOTAL				**1,298,322**

[1]Unit costs are based upon 2004 price levels and do not include contractor overhead and profit. Costs are from RS Means unless noted otherwise.